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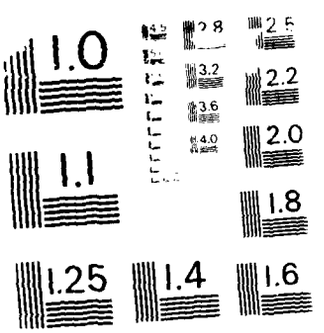

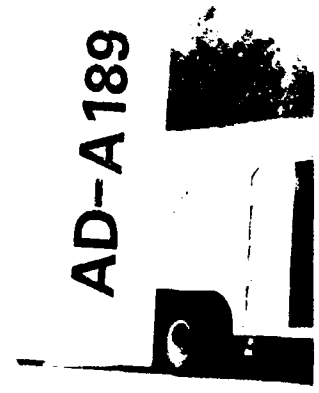

MISCELLANEOUS PAPER GL-87-30

CONDITION SURVEY AND PAVER IMPLEMENTATION MACDILL AUXILIARY FIELD NO. 1 (AVON PARK RANGE), FLORIDA

by

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Geotechnical Laboratory

DEPARTMENT OF THE ARMY
Waterways Experiment Station, Corps of Engineers
PO Box 631, Vicksburg, Mississippi 39180-0631

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Pavement condition index
PAVER implementation

19 ABSTRACT (Continue on reverse if necessary and identify by block number)

A pavement condition survey was performed at MacDill Air Force Base Auxiliary Field No. 1, Avon Park Range, Florida, in March 1986 for the purpose of determining the pavement condition index of the airfield features and for performing the initial implementation of the PAVER pavement management system.

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PREFACE

The condition survey described in this report was requested by Military Interdepartmental Purchase Request (MIPR) No. 86-00-34 dated 20 December 1985 from the 56 CSG/DEU, MacDill Air Force Base, Florida, to the US Army Engineer Waterways Experiment Station (WES), Vicksburg, Miss.

The condition survey at MacDill Auxiliary Field No. 1 (Avon Park Range), Florida, was performed by a WES condition survey team on 19 March 1986. The team consisted of Messrs. R. A. Bentsen, P. S. McCaffrey, Jr., and D. D. Mathews and Mses. M. J. Horihan and M. A. Kennedy, Pavement Systems Division (PSD), Geotechnical Laboratory (GL). This report was prepared by Messrs. Bentsen and McCaffrey under the supervision of Messrs. R. W. Grau, Chief, Prototype Testing and Evaluation Unit, PSD; J. W. Hall, Jr., Chief, Engineering Investigations, Testing, and Validation Group, PSD; and H. H. Ulery, Jr., Chief, PSD. The work was under the general supervision of Dr. W. F. Marcuson III, Chief, GL, WES. Ms. Odell F. Allen, Information Products Division, Information Technology Laboratory, edited the report.

COL Dwayne G. Lee, CE, was the Commander and Director of WES during the preparation and publication of this report. Dr. Robert W. Whalin was Technical Director.

CONTENTS

CONVERSION FACTORS, NON-SI TO SI (METRIC)
UNITS OF MEASUREMENT

Non-SI units of measurement used in this report can be converted to SI (metric) units as follows:

Multiply	By	To Obtain
feet	0.3048	metres
inches	2.54	centimetres
square feet	0.09290304	square metres
square yards	0.8361274	square metres

CONDITION SURVEY AND PAVER IMPLEMENTATION MACDILL AUXILIARY FIELD NO. 1 (AVON PARK RANGE), FLORIDA

PART I: INTRODUCTION

Background

1. This report describes the condition survey and initial implementation of a pavement management system utilizing the PAVER system of the airfield pavements at MacDill Auxiliary Field No. 1 (Avon Park Range), Fla. The implementation was performed to provide base engineers with the initial data base required for making pavement management decisions concerning costs and maintenance requirements. The condition survey was performed by the US Army Engineer Waterways Experiment Station (WES) on 19 March 1986.

Objective and Scope

2. The overall objective of this project was to determine the pavement condition of the airfield pavements at Avon Park Range and to input the information into a PAVER data base to provide the base engineers with a permanent data base to use for future pavement management decisions. This objective was accomplished by:

a. Performing a condition survey of the pavements in accordance with AFR 93-5 (Headquarters, Department of the Air Force 1981).*

b. Inputting the pavement network and condition survey information into PAVER to calculate a pavement condition index (PCI) of each of the pavement features.

c. Completing the data base implementation by compiling pavement construction data and inputting the information into the PAVER data base.

d. Producing detailed drawings of the pavement features to ensure that future condition surveys will be performed at the same locations as the one performed for this report.

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* Headquarters, Department of the Air Force. 1981. "Airfield Pavement Evaluation Program," Air Force Regulation AFR 93-5, Washington, DC.

PART II: PAVEMENT CONDITION SURVEY

Introduction

3. A pavement condition survey is performed to determine the present surface condition of the various pavement features on an airfield. The procedure used in performing the condition survey was developed by the US Army Corps of Engineers and has been accepted as a regulation by the US Air Force (Headquarters, Department of the Air Force 1981).* A knowledge of the condition survey procedures discussed in AFR 93-5 is required for the use and understanding of this report.

Pavement Definition and Identification

4. The pavement network is divided into three specific units in order to manage the pavement network effectively. The three units of division are the feature, the section, and the sample unit. The method for dividing the pavement network is detailed in AFR 93-5 and is briefly discussed here.

5. Airfield pavement features, also known as branches, are defined by various parameters such as the pavement type, construction history, and pavement usage. The feature designations used for the condition survey of Avon Park Range were established in the "Airfield Pavement Evaluation Report, Avon Park Range, Florida," published in July 1980 by the US Air Force Engineering and Services Center, Tyndall AFB, Fla. These features have been so designated under strict guidelines, and any changes to them should be highly justified. Locating the features on the airfield itself is necessary before the performance of the condition survey can proceed. Figure 1 gives a layout of the airfield pavements at Avon Park Range and the pavement features contained within it. Figure 2 indicates the pavement types at Avon Park Range.

6. After each pavement feature has been defined, further division of the feature may be required for reasons such as traffic flow. The further division of features is done into sections. For instance, a runway feature

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* Headquarters, Department of the Air Force. 1981. "Airfield Pavement Evaluation Program," Air Force Regulation AFR 93-5, Washington, DC.

may be 150 ft* wide, but the majority of the traffic occurs in the middle of the feature. Therefore, a section is defined in the center of the feature with additional sections defined on either side of the middle section. Note that if a featur requires no division for definition purposes, it is still considered to contain one section.

7. After the pavement section definition has been completed, the section is divided into sample units, which are conveniently sized areas of pavement on which the inspection is performed. A sample unit on asphalt concrete (AC) pavement is 5,000 sq ft in area, and a sample unit on portland cement concrete (PCC) pavement consists of 20 slabs. A pavement section is divided into sample units for condition survey purposes only. Recognizing that not all sample units can be 5,000 sq ft or 20 slabs, deviations of 50 percent on either side of these values are allowed for survey purposes.

8. When a section has been divided into sample units, it has been properly prepared for the survey. Inspection of all of the sample units within a section could require considerable amount of time. Therefore, the random sampling method was developed to provide an adequate calculation of the PCI while inspecting only a portion of the sample units in a section. The method, further defined in AFR 93-5, allows for a reduction in the number of the sample units surveyed without a significant loss of accuracy in the calculation of the PCI. It should be noted, however, that the inspection of all the sample units may be necessary for estimation of maintenance and repair work.

9. An essential concept in pavement management is determining the deterioration of the pavement surface over time. The PCI is used in the PAVER system to determine this deterioration. Determining the PCI of a pavement section at different time intervals requires that the same sample units of the section be surveyed to get a precise idea of the deterioration rate. Drawings of each of the pavement features and any section divisions have been included in this report to illustrate the sample units within each feature to ensure that future condition surveys are conducted at these same locations. These illustrations are found in Figures 3 through 12. The circled sample units in the figures indicated those that were surveyed.

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* A table of factors for converting non-SI units of measurement to SI (metric) units is presented on page 3.

Pavement Inspection

10. The performance of a condition survey consists of inspecting the pavement surface for various types of distresses, determining the severity of each distress found, and measuring the amount of distress within the sample unit. Distresses on AC pavement are measured in either linear feet or square feet within the sample unit, and those on PCC pavement are measured by counting the number of slabs affected within the sample unit.

11. The product of the condition survey is the PCI of the sample unit. The PCI is a value from 0 to 100 (worst to best, respectively) of the surface condition of the pavement. The PCI is obtained by determining a deduct value for the amount of each of the distress types and severities found in the inspection, determining a corrected deduct value for the combined effect of various distresses on the pavement condition, and subtracting the corrected deduct value from 100. A pavement with no distress has a PCI of 100 with varying amounts of distress decreasing the PCI value to a possible low of 0. Pavement condition ratings (excellent to failed) are assigned to different levels of PCI values; these ratings and their respective PCI value definitions are shown in Figure 13. The PCI of the pavement section is calculated by averaging the PCI's of the sample units surveyed.

12. The majority of the pavement features at Avon Park Range are rated from fair to very good condition with one feature rated poor. Figure 14 illustrates the condition ratings of the features at Avon Park Range, and Table 1 describes the more prominent distresses observed in the features. Photos 1 through 7 show various distresses that were observed on the airfield pavements.

PART III: PAVER DATA BASE IMPLEMENTATION

13. The use of the PAVER system requires knowledge of both computers and the PAVER system itself. This report does not describe the operation of a computer; however, it does outline the necessary PAVER procedures in moderate detail. The "PAVER User's Guide" by M. Y. Shahin, ADP-356-1,* goes into specific detail of all the procedures for setting up and using a PAVER data base and should be used as a reference when performing operations in the PAVER system.

14. The PAVER system consists of five different system functions: data entry, system sign-on, data base update, report generation, and data analysis. Performing each function requires the use of specific programs, files, and procedures. Data entry, system sign-on, and data analysis do not directly interact with the PAVER data base, but data base update and report generation require data base interaction.

Data Entry

15. The pavement network data are entered into the PAVER data base in a logical order that defines the features and sections first; the additional information that allows the user to perform data base related operations such as PCI calculation and report generation is then entered. The data must be in specific formats for it to be accepted by the data base. Three data input programs are used to prepare data into the specific formats: PAVERIN, EDITOR, and REFORMT. All of these programs have been written in the BASIC computer language and are operable on a personal computer that contains a BASIC system. The PAVERIN program is used to input the data into the correct formats, the EDITOR program is used for editing any errors that may have been placed in the data, and the REFORMT program is used to prepare the data for uploading onto the mainframe computer.

16. The two ways to collect the condition survey data in the field are by recording the data manually on condition survey data sheets and later placing the data into PAVER format using the PAVERIN data input program, or by

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* US Army Construction Engineering Research Laboratory and US Army Facilities Engineering Support Agency 1985.

inputting the data directly into the FIELD program on a portable computer. The FIELD program places the data into PAVER format as it is entered into the computer and saves the data in a file that can be directly uploaded to the mainframe computer. The data for Avon Park Range were collected and compiled using a portable computer.

17. The data for physical properties and construction history of the pavements at Avon Park Range were obtained from the 1980 evaluation report and from base engineering personnel. The physical property data, as the data were entered into the data base, are contained in Table 2.

System Sign-On

18. The mainframe PAVER system currently resides on a Control Data Corporation (CDC) computer and is accessible through a remote terminal via a telephone link. The telephone link is achieved by using a modem and appropriate communication software. Access to the system requires dialing the CDC computer for connection and then entering the appropriate access codes to sign-on to the computer. The access codes (user ID, password, and charge number) are obtained when a charge account has been set up with CDC.

Data Upload and Data Base Update

19. Data is added to the data base either interactively or by using the BATCH method. The interactive method is used when the user is on-line to the CDC computer. This method is easier to perform but is more expensive. The BATCH method involves transferring the data file created with the PAVERIN or FIELD programs from the personal computer to the CDC mainframe. Using either operation involves creating the file DATAFL on the CDC computer from which the data is read into the data base. After DATAFL is prepared, the PAVER system checks it for errors, and after corrections have been made, the data are loaded into the data base.

Report Generation and Data Analysis

20. The PAVER system generates reports that provide summary of specific information based on the data stored in the mainframe data base and also calculates information such as budget needs from data and analysis programs provided by PAVER. These reports can be generated either interactively or through a BATCH process as shown in Table 3. The BATCH process produces the report when the user is not signed onto the CDC computer and is more cost-effective when generating large amounts of information. The interactive process, performed while the user is signed-on, can be used effectively when generating smaller reports and detecting data base errors.

21. There are two types of data analysis programs in the PAVER system: those that access the data base and those that do not access the data base. These programs are listed in Table 4. The difference in the two types is that the data base must be on line for the report to operate. The user responds to questions that the program asks, and then analysis results are produced based on those responses. The analysis reports can only be generated using the interactive process.

Table 1

Character and Condition of Airfield Facilities, Avon Park Range

Facility Name	Dimensional Area Length x Width, ft Area, sq yd	P or S*	General Comments
Runway 5-23	5,385 x 150 89,750	P	The PCC ends of the runway are in fair to good condition. Low- and medium-severity linear cracks and large, low-severity patches of these cracks are evident. Also present are medium-severity joint seal damage, low-severity corner breaks, low-severity small patches, and low-severity joint and corner spalls. The AC interior of the runway is in fair condition. Low- and medium-severity block cracking and weathering are present over most of the surface. An AC overlay is scheduled for first quarter, FY 87.
Taxiway A	2,850 x 50 15,833	P	Low-severity block cracking and weathering were present over much of the AC surface with some of these distresses being rated medium severity.
Taxiway B	1,450 x 50 8,056	P	Low-severity weathering was evident on most of the AC surface of this taxiway. Low- and medium-severity block and longitudinal and transverse cracking were also present.
Taxiway C	3,100 x 50 21,611	P	The AC portion of this taxiway was distressed with low-severity weathering and low- and medium-severity block cracking as well as low- and medium-severity longitudinal and transverse cracking.

(Continued)

* P = Primary; S = Secondary.

Table 1 (Concluded)

Facility Name	Dimensional Area Length x Width, ft Area, sq yd	P or S*	General Comments
Taxiway C (Cont.)	3,100 x 50 21,611		The PCC portion was not rigorously surveyed but contains many of the same distresses as the PCC portion of the runway (linear cracks, small and large patches, and joint and corner spalls).
Apron B	varies x 400 23,556	P	Small, low-severity patches, shrinkage cracks, and high-severity joint seal damage were present in the PCC surface of this facility. Also evident were low-severity linear cracks and low-severity joint and corner spalls.
Apron D	varies x varies 23,764	S	Block cracking of all severity levels was evident over a majority of the AC surface. Small amounts of oil spillage were also observed.
Apron E	varies x varies 7,924	S	Linear cracks of all severities, high-severity joint seal damage, and low-severity small patches were observed in the PCC surface. Also evident were low-severity large patches, shrinkage cracks, and low-severity joint and corner spalls.

Table 2

SUMMARY OF PHYSICAL PROPERTY DATA

FACILITY					OVERLAY PAVEMENT			PAVEMENT			BASE			SUBBASE			SUBGRADE	
FEATURE	IDENTIFICATION	LENGTH (FT)	WIDTH (FT)	GENERAL CONDITION PCI	THICKNESS (IN)	DESCRIPTION	FLEX STR (PSI)	THICKNESS (IN)	DESCRIPTION	FLEX STR (PSI)	THICKNESS (IN)	DESCRIPTION	CBR % / K PSI/IN	THICKNESS (IN)	DESCRIPTION	CBR %	DESCRIPTION	CBR % / K PSI/IN
R1B	Runway 5-23 Sta 0+00 to 3+00	300	150	Fair				7.0	PCC	540	2.0	Sand (SM)	 375	3.0	AC		Sand (SM)	
R2B	Runway 5-23 Sta 3+00 to 10+00	200 200	150	Fair				3.25	AC		5.5	Lime rock (SM)	80	2.0 5.5 5.5	AC Soil cement Sand (SP-SM)	100 100	Sand (SP-SM)	30
R3C	Runway 5-23 Sta 10+00 to 43+85	3,380	150	Fair				3.25	AC		.5	Lime rock (SM)	80	2.0 5.5 5.5	AC Soil cement Sand (SP-SM)	100	Sand (SP-SM)	30
R4B	Runway 5-23 Sta 43+80 to 48+35	450	150	Fair				3.0	AC		5.5	Lime rock (SM)	80	2.5 7.5 5.0	AC Soil cement Sand (SM)	100	Sand (SM)	35
R5B	Runway 5-23 Sta 48+35 to 53+85	550	150	Fair to Good				7.5	PCC	510	2.0	Sand (SM)	 375	3.0	AC		Sand (SP-SM)	
T1B	Taxiway A	2,850	50	Fair				3.0	AC		5.0	Lime rock (SM)	80	2.5 11.0	AC Soil cement	100 100	Sand (SM)	19
T2B	Taxiway B	650	50	Good				5.0	AC		5.0	Lime rock (SM)	80	2.5 11.0	AC Soil cement	100 100	Sand (SM)	19
T3B	Taxiway B	800	50	Fair				3.0	AC		5.0	Lime rock (SM)	80	2.5 11.0	AC Soil cement	100 100	Sand (SM)	19
T4B	Taxiway C	2,950	50	Fair				3.0	AC		5.0	Lime rock (SM)	80	1.5 7.0	AC Soil cement	100 100	Sand (SM)	25

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(Continued)

Table [illegible] (Continued)

SUMMARY OF PHYSICAL PROPERTY DATA

FACILITY					OVERLAY PAVEMENT			PAVEMENT			BASE			SUBBASE			SUBGRADE	
FEATURE	IDENTIFICATION	LENGTH (FT)	WIDTH (FT)	GENERAL CONDITION PCI	THICKNESS (IN)	DESCRIPTION	FLEX STR (PSI)	THICKNESS (IN)	DESCRIPTION	FLEX STR (PSI)	THICKNESS (IN)	DESCRIPTION	CBR % / K PSI/IN	THICKNESS (IN)	DESCRIPTION	CBR %	DESCRIPTION	CBR % / K PSI/IN
T5B	Taxiway C	450	Varies	Fair to Good				[illegible]	[illegible]	[illegible]	[illegible]	Sand (SM)	375	[illegible]	AC		Sand (SM)	
A1B	Apron B	Varies	400	Very good				[illegible]	[illegible]	[illegible]	[illegible]	Sand (SM)	225				Sand (SM)	
A2E	Apron E	Varies	Varies	Very good				[illegible]	[illegible]	[illegible]	[illegible]	[illegible] (SM)	275				Sand (SM)	
A3B	Apron D	Varies	Varies	[illegible]				[illegible]	[illegible]	[illegible]	[illegible]	[illegible] cement	(60)	[illegible]	Sand (SM)	15	Sand (SM)	18

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Table 3

PAVER Reports

Interactive or BATCH Reports

LIST	-	Lists the branch number, branch name, and number of sections in each branch defined by the GENERATE command.
INV	-	Provides inventory information of pavement sections in the data base.
INSPECT	-	Provides a summary of all PCI and distress information on pavement sections in the data base.
INSPCUR	-	Provides a summary of the PCI and distress information on pavement sections in the data base for the most recent PCI survey for a given section.
SAMPLE	-	Lists both the summary and sample unit PCI and distress information on pavement sections in the data base.
SAMPCUR	-	Lists both the summary and sample unit PCI and distress information on pavement sections in the data base for the most recent PCI survey for a given section.
WORKREQ	-	Provides a list of user identified work requirements for pavement sections.
WORKHIS	-	Provides a list of user identified work requirements that have been performed on pavement sections.
RECORD	-	Provides detailed information on pavement sections in the data base.
POLICY	-	Prints the maintenance policy currently stored in the data base. The maintenance policy is used in reports MRG and ANALOC.
PCI	-	A list of section PCI's, ranked by PCI (low to high).
PCIA	-	A list of section PCI's in alphabetical order.

BATCH Processed Only Reports

FREQ	-	PCI frequently diagram of the current year or any year in the future.
BUDPLAN	-	5-year projected budget level based on average cost of repair for each surface type.

(Continued)

Table 3 (Concluded)

BATCH Processed Only Reports (Continued)

SCHED	-	Schedule of sections to be inspected during a 5-year period.
CNDHIST	-	PCI time curve for a specific section, including 5-year PCI projection.
MRG	-	Repair cost and, if desired, overlay cost based on user's maintenance and repair policy.
SPECIFY	-	Personalized report based on user selected data elements and criteria.
ANALOC	-	Provides the user with three reports: (1) analysis of localized repair of a section, (2) PCI after repair of that section, (3) MRG report for that section.

Table 4

PAVER Analysis Programs

Do Not Access the Data Base

ECON1	-	Economic analysis program that uses present worth analysis and equivalent annual uniform cost.
VOL7	-	PCI prediction models for airfield AC or PCC pavements.
PREDICT	-	Statistical analysis routine to predict the quantity and severity of a given distress type over a future period.
EVAL	-	Provides recommended feasible maintenance and rehabilitation alternatives based on user response to an evaluation summary.
CONLOC	-	PCI prediction of a pavement section after localized repair is performed.
BENEFIT	-	Computes a benefit value based on the area under the PCI time curve weighted by utility (PCI preference rating and relative weight values (relative pavement performance)).
BUDOPT	-	Optimizes a fixed budget for a set of projects using equivalent uniform annual costs and benefits.
PCICALC	-	This allows users to calculate the PCI without entering data into the data base.
PCICHEC	-	Checks the data that goes into PCICALC.
PCIRES	-	Gives the results from the calculated PCI for later printing.

Does Access the Data Base

ANALOC	-	Analysis of localized repair with PCI after repair report and MRG after repair report.

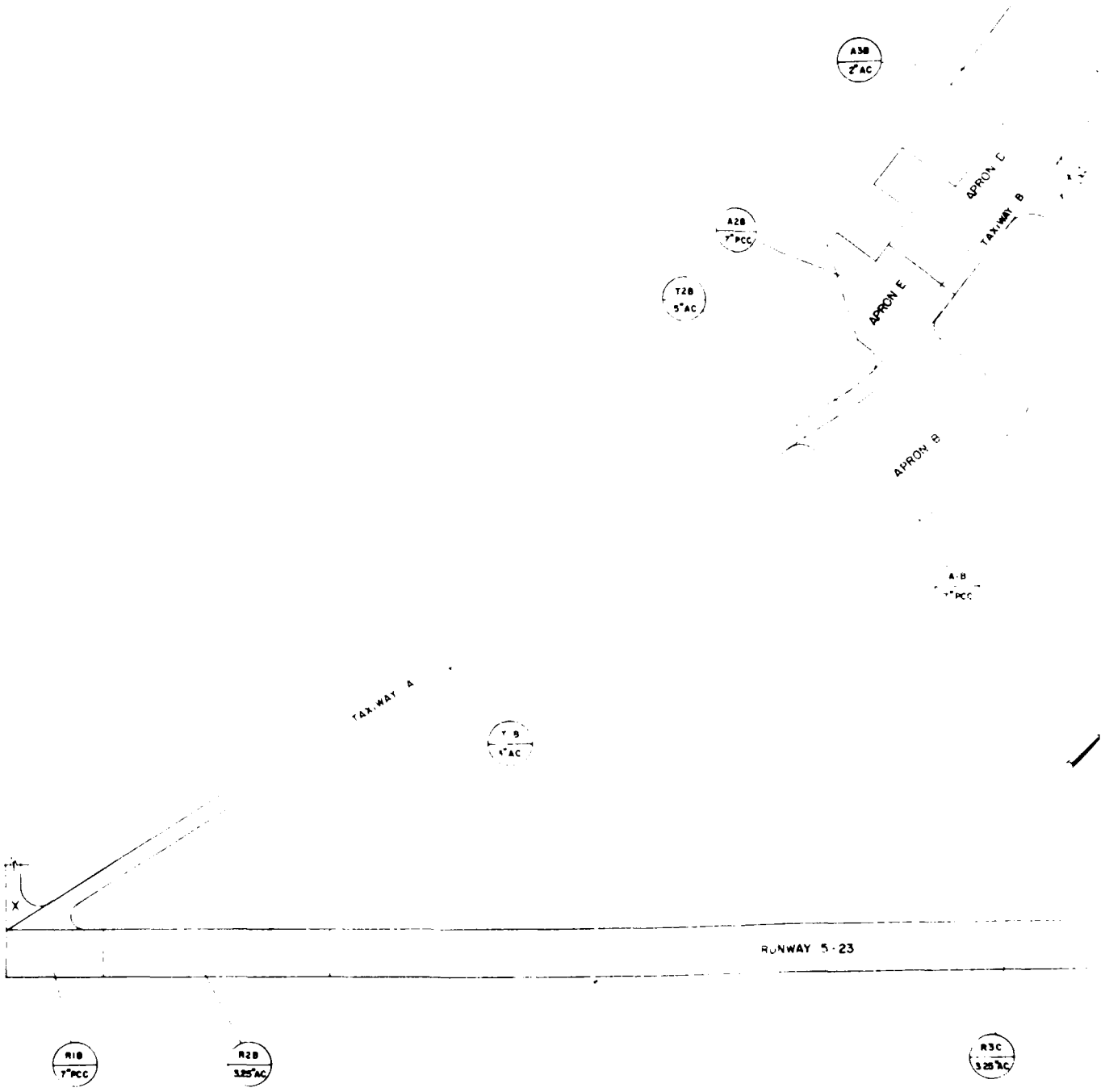
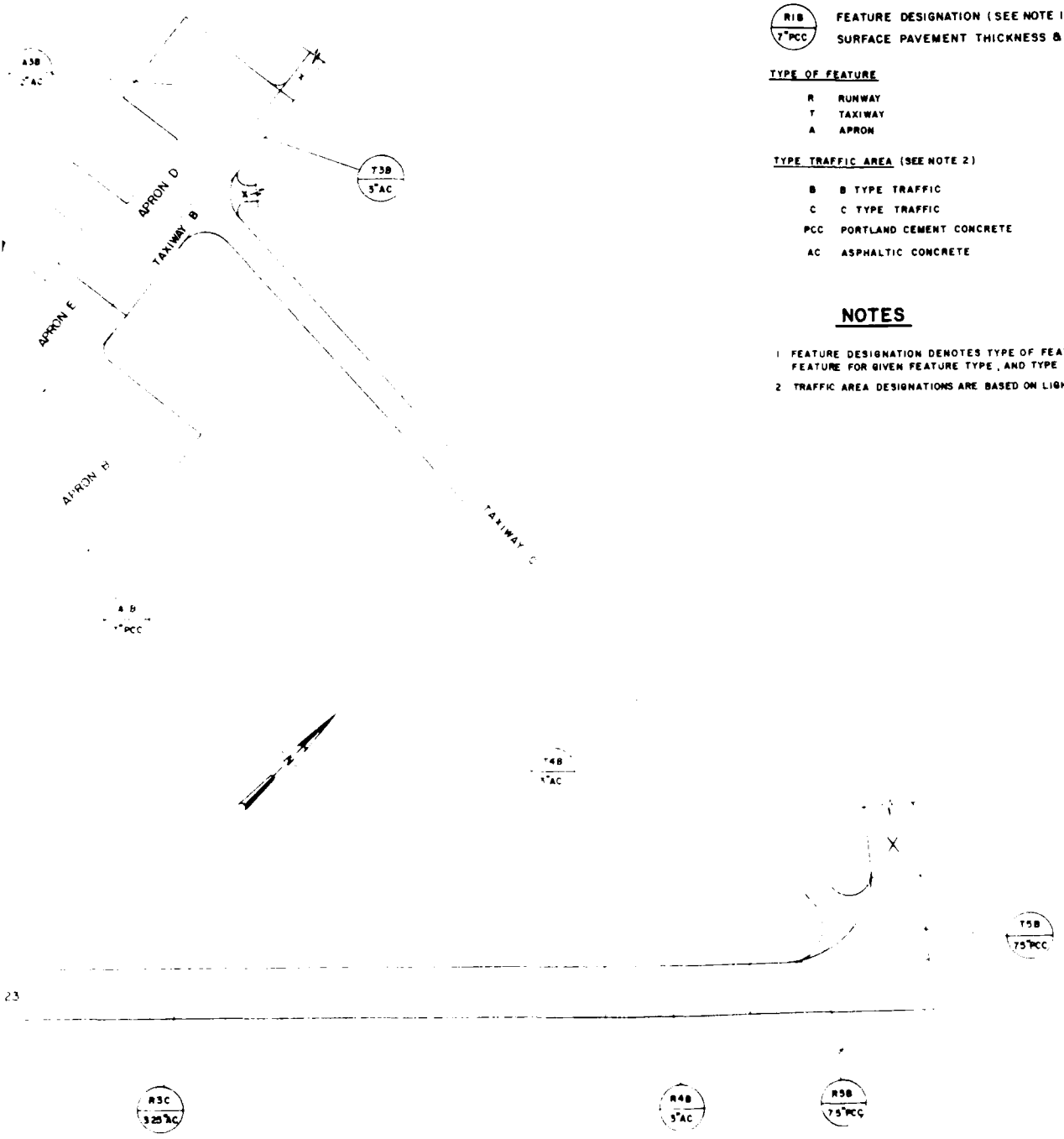


Figure 1. Pavement layout and feature identifi



LEGEND

RIB / 7"PCC — FEATURE DESIGNATION (SEE NOTE 1) / SURFACE PAVEMENT THICKNESS & TYPE

TYPE OF FEATURE

R	RUNWAY
T	TAXIWAY
A	APRON

TYPE TRAFFIC AREA (SEE NOTE 2)

B	B TYPE TRAFFIC
C	C TYPE TRAFFIC
PCC	PORTLAND CEMENT CONCRETE
AC	ASPHALTIC CONCRETE

NOTES

1 FEATURE DESIGNATION DENOTES TYPE OF FEATURE, NUMBER OF FEATURE FOR GIVEN FEATURE TYPE, AND TYPE TRAFFIC AREA

2 TRAFFIC AREA DESIGNATIONS ARE BASED ON LIGHT LOAD CRITERIA

t and feature identification at Avon Park Range

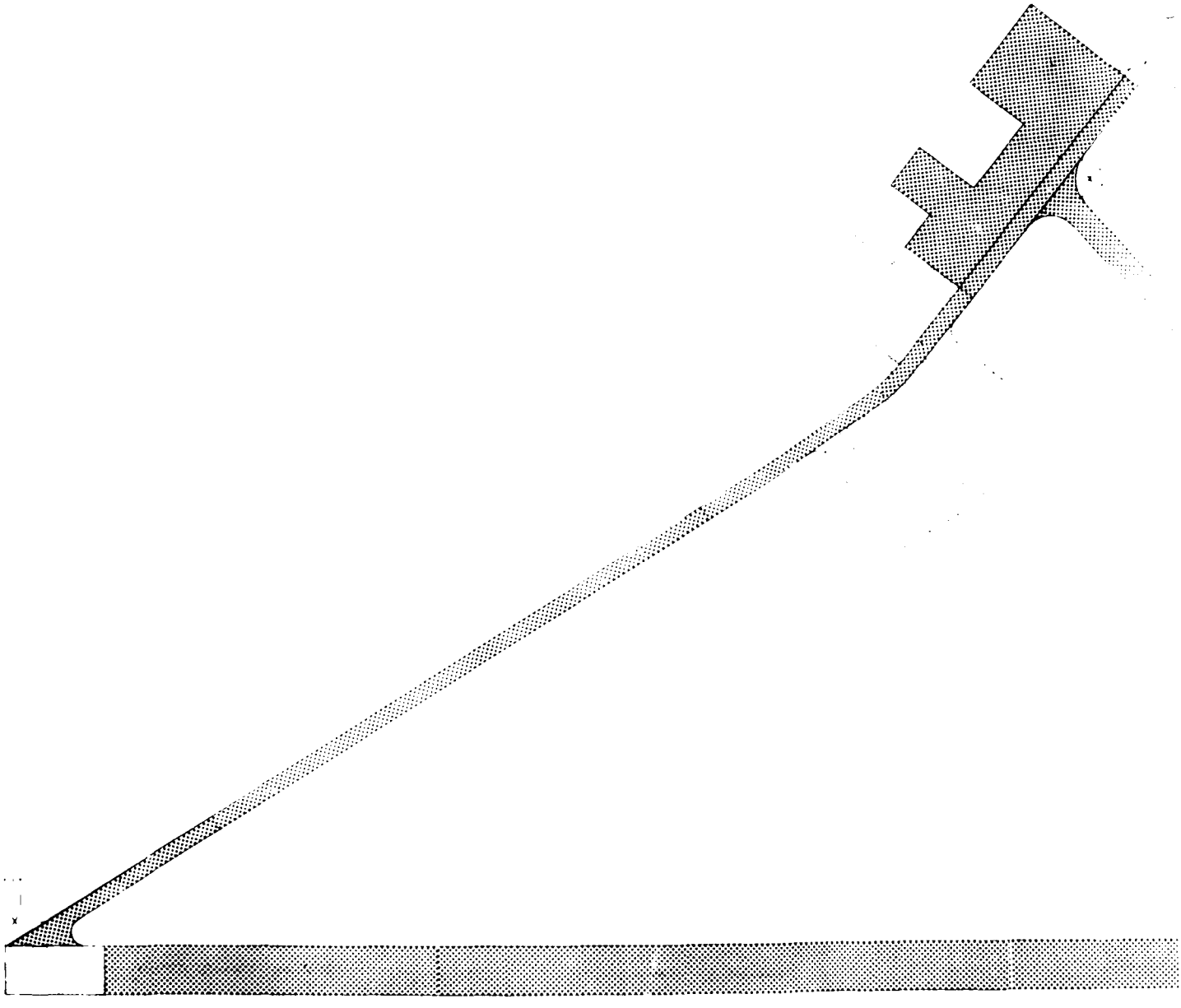
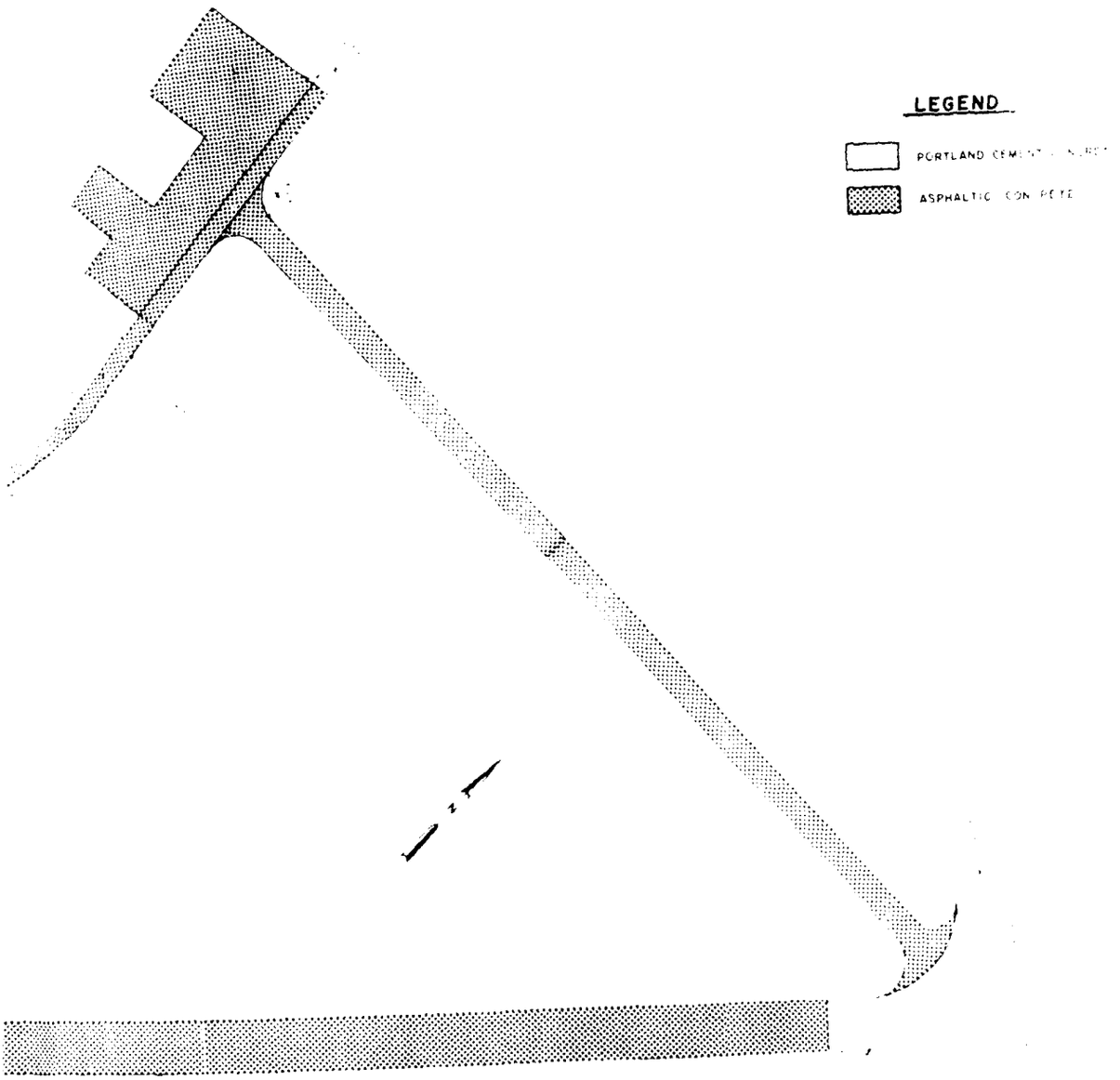


Figure 2. Pavement types at Avon Par



2. Pavement types at Avon Park Range

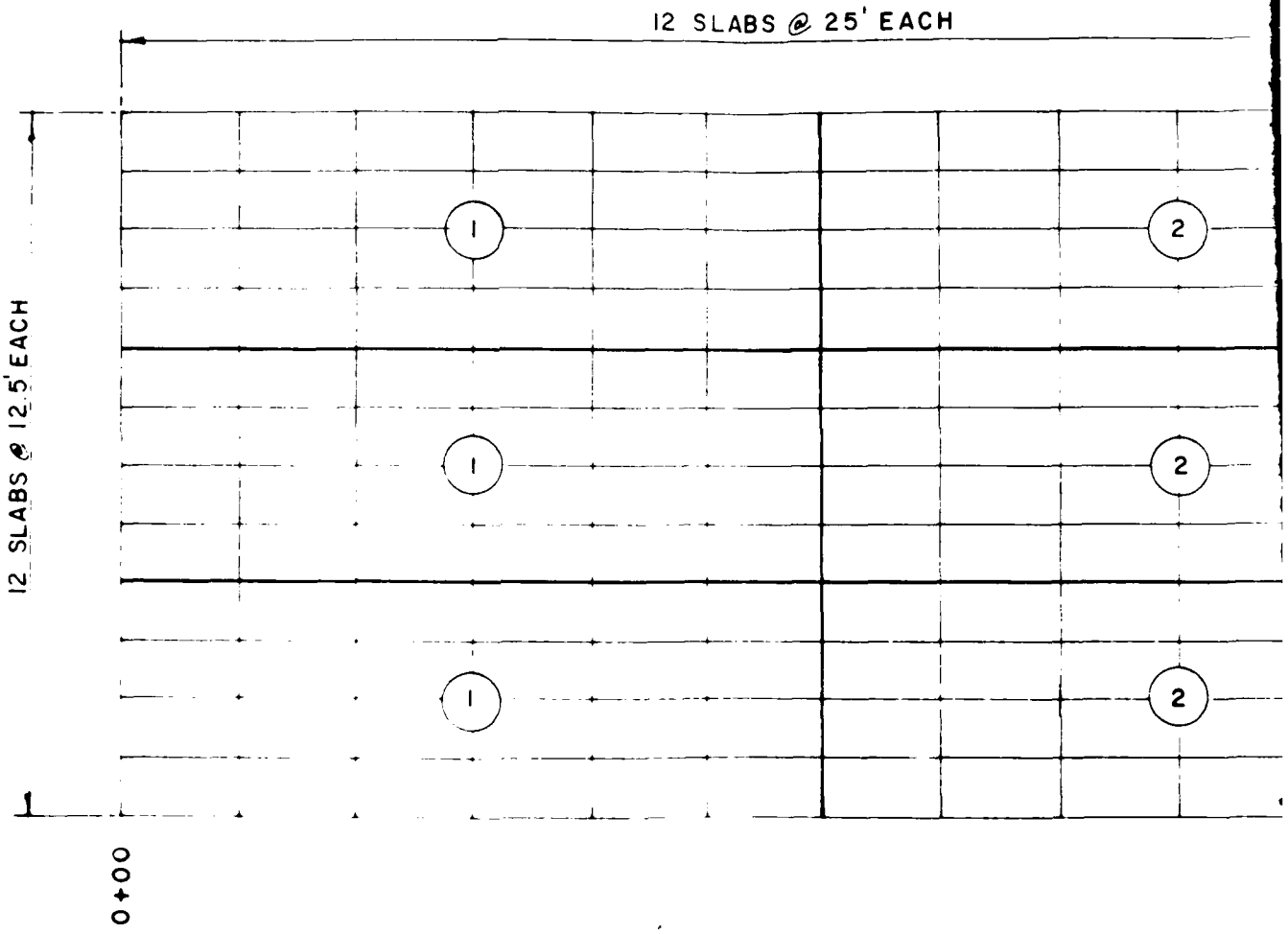
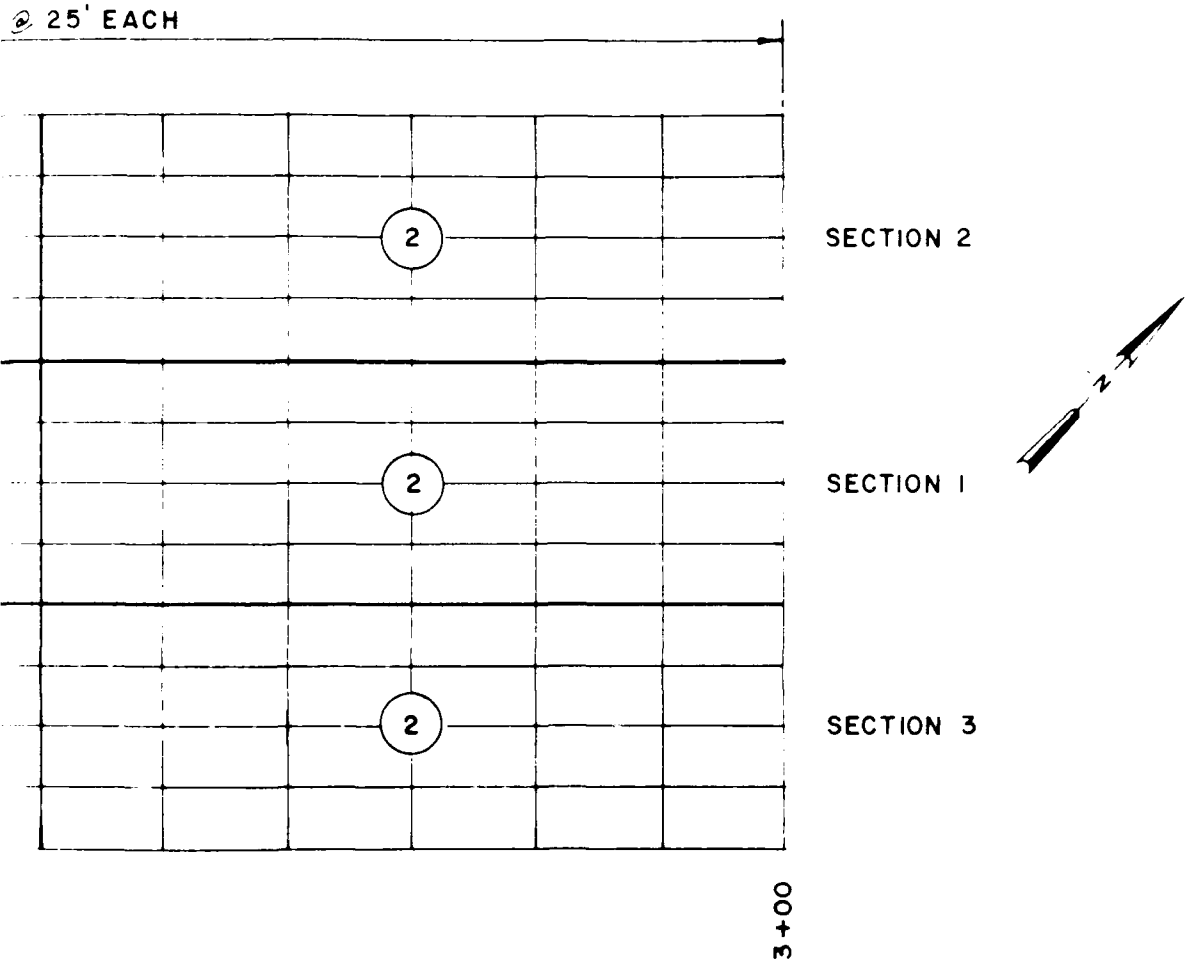


Figure 3. Sample unit layout, Runway 5-23 (Feature



unit layout, Runway 5-23 (Feature R1B)

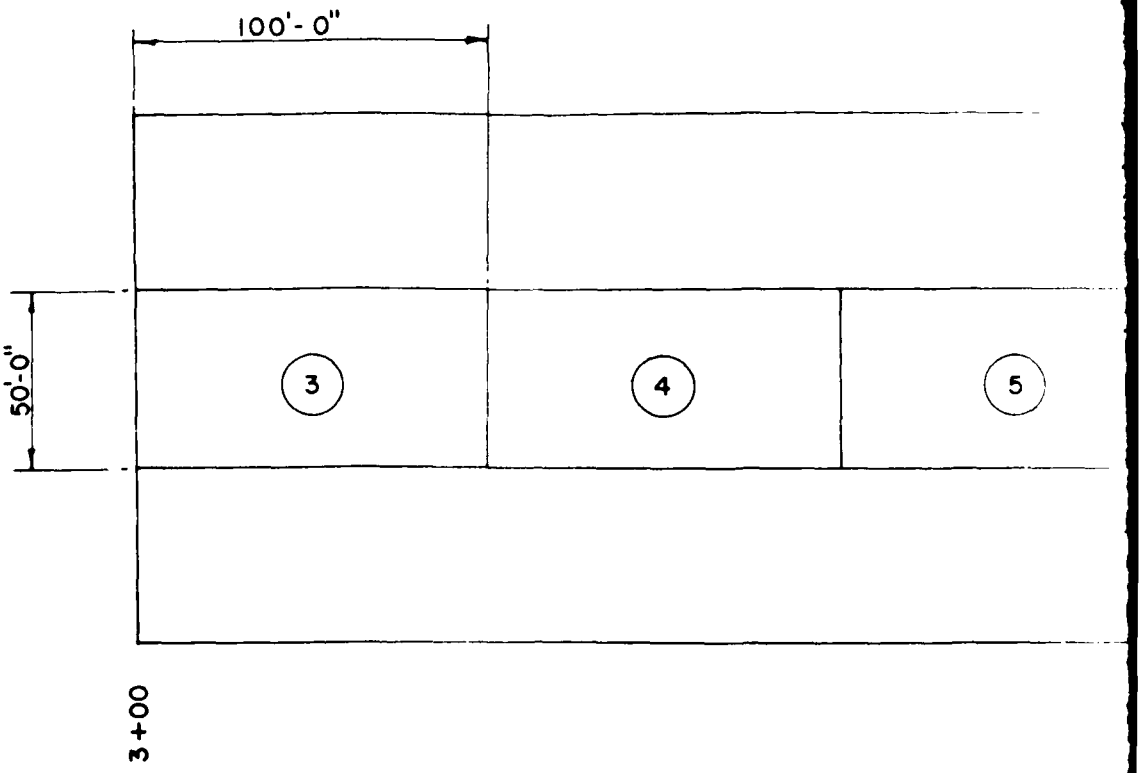


Figure 4. Sample

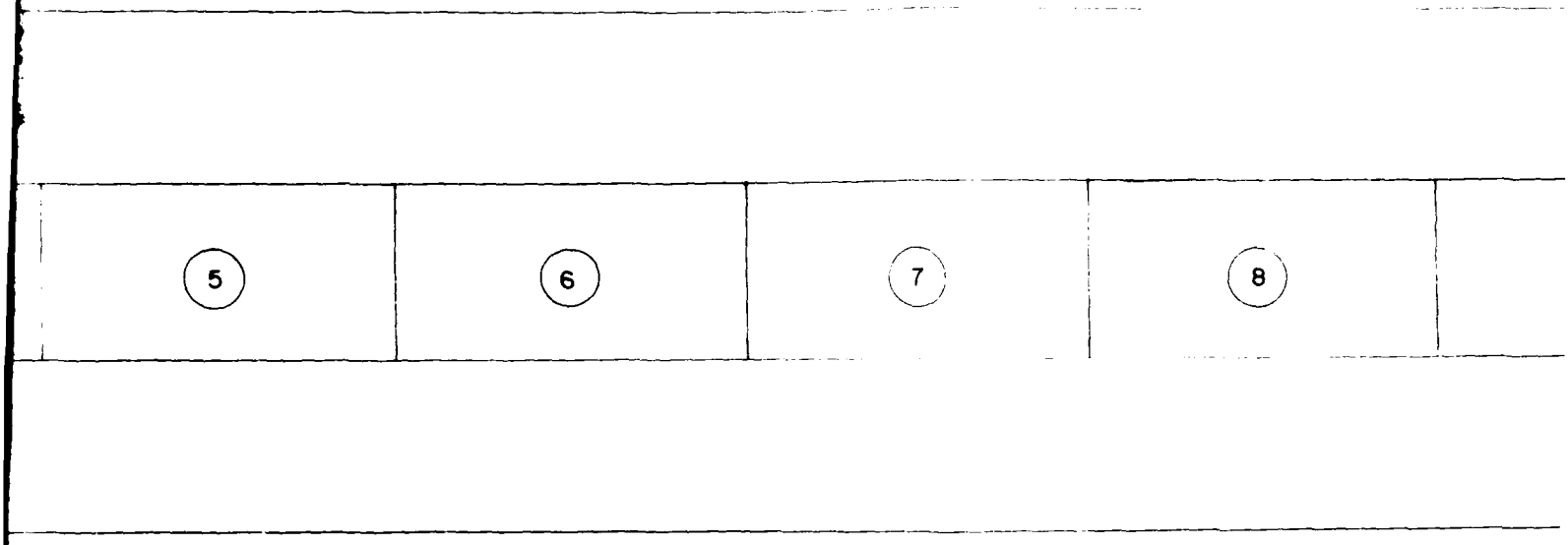
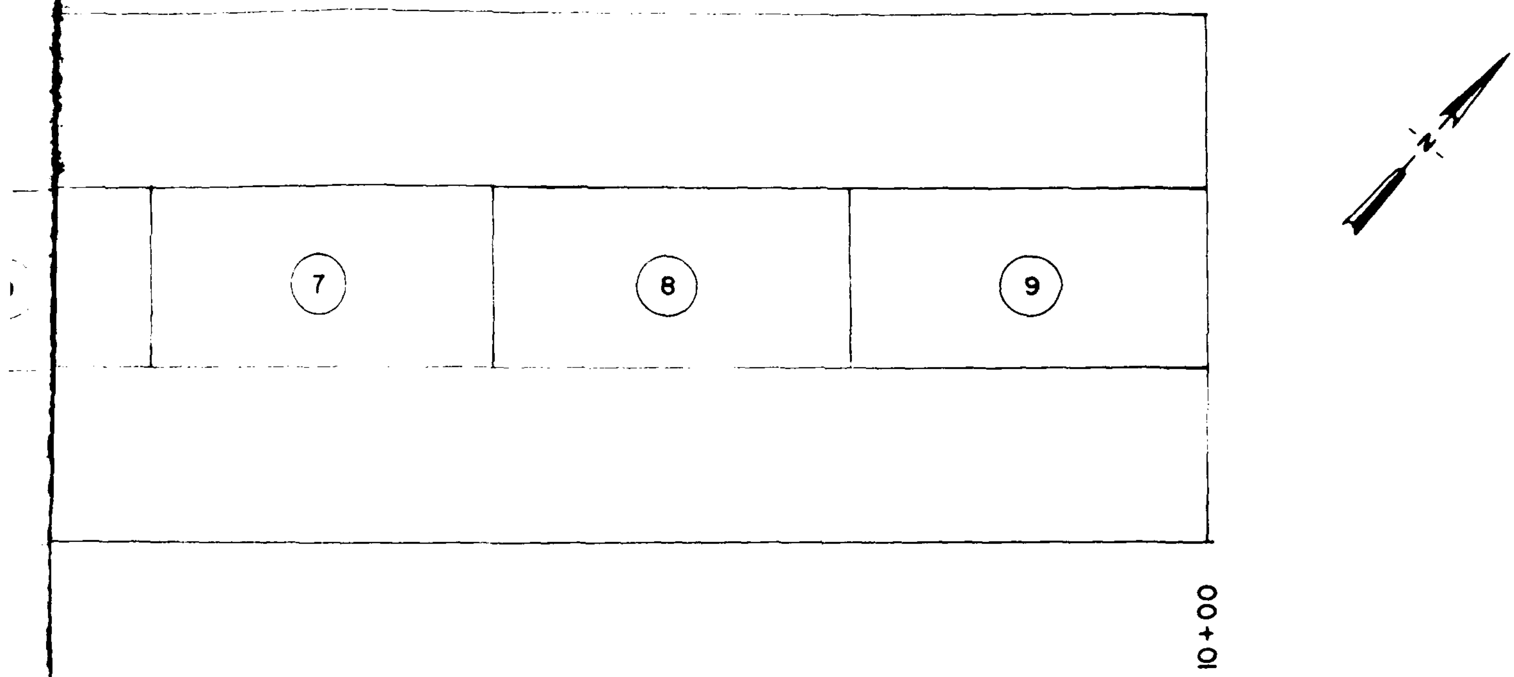


Figure 4. Sample unit layout, Runway 5-23 (Feature R2



-23 (Feature R2B)

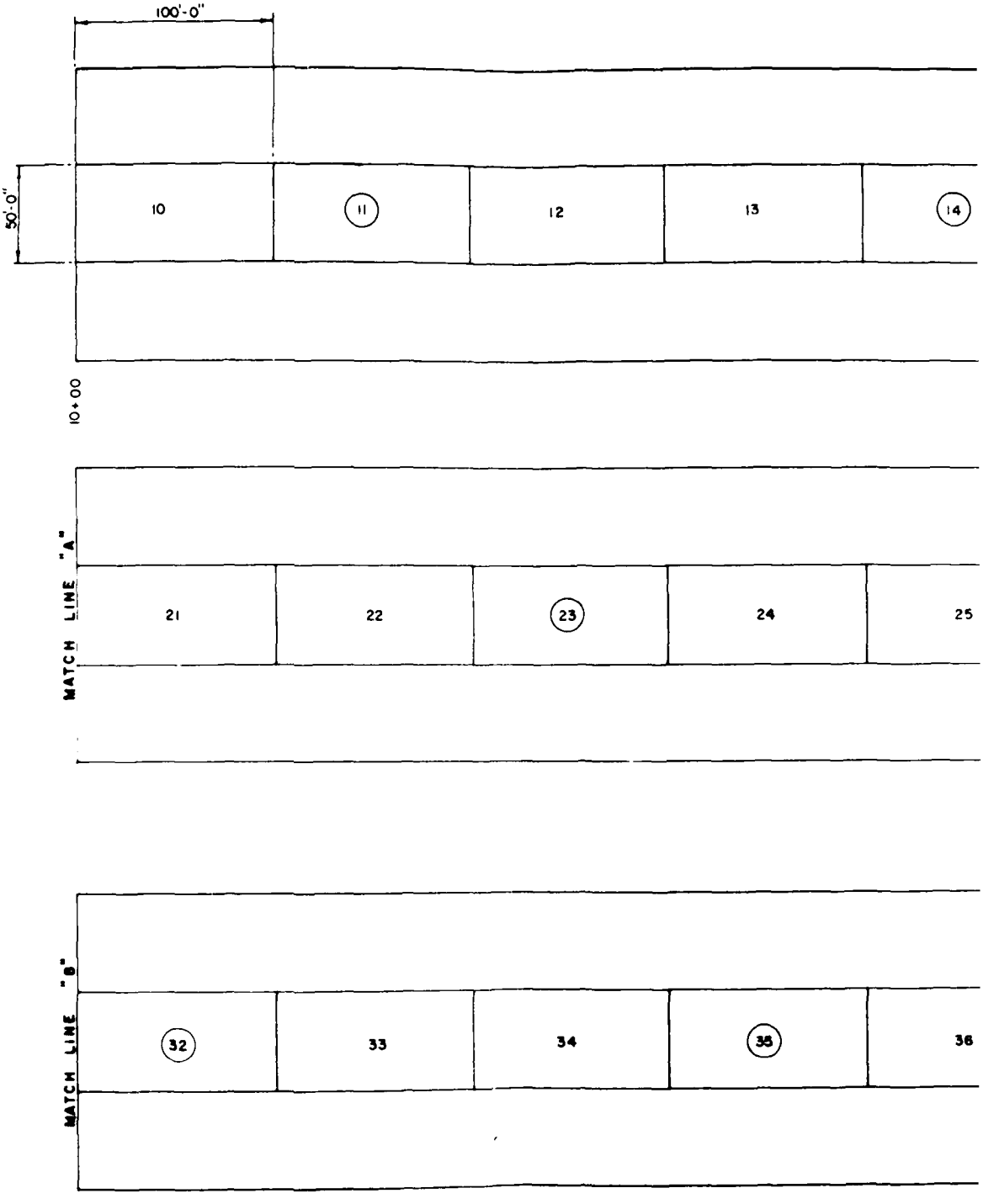

100'-0"
50'-0"
10
11
12
13
14
10+00
MATCH LINE "A"
21
22
23
24
25
MATCH LINE "B"
32
33
34
35
36

Figure 5.

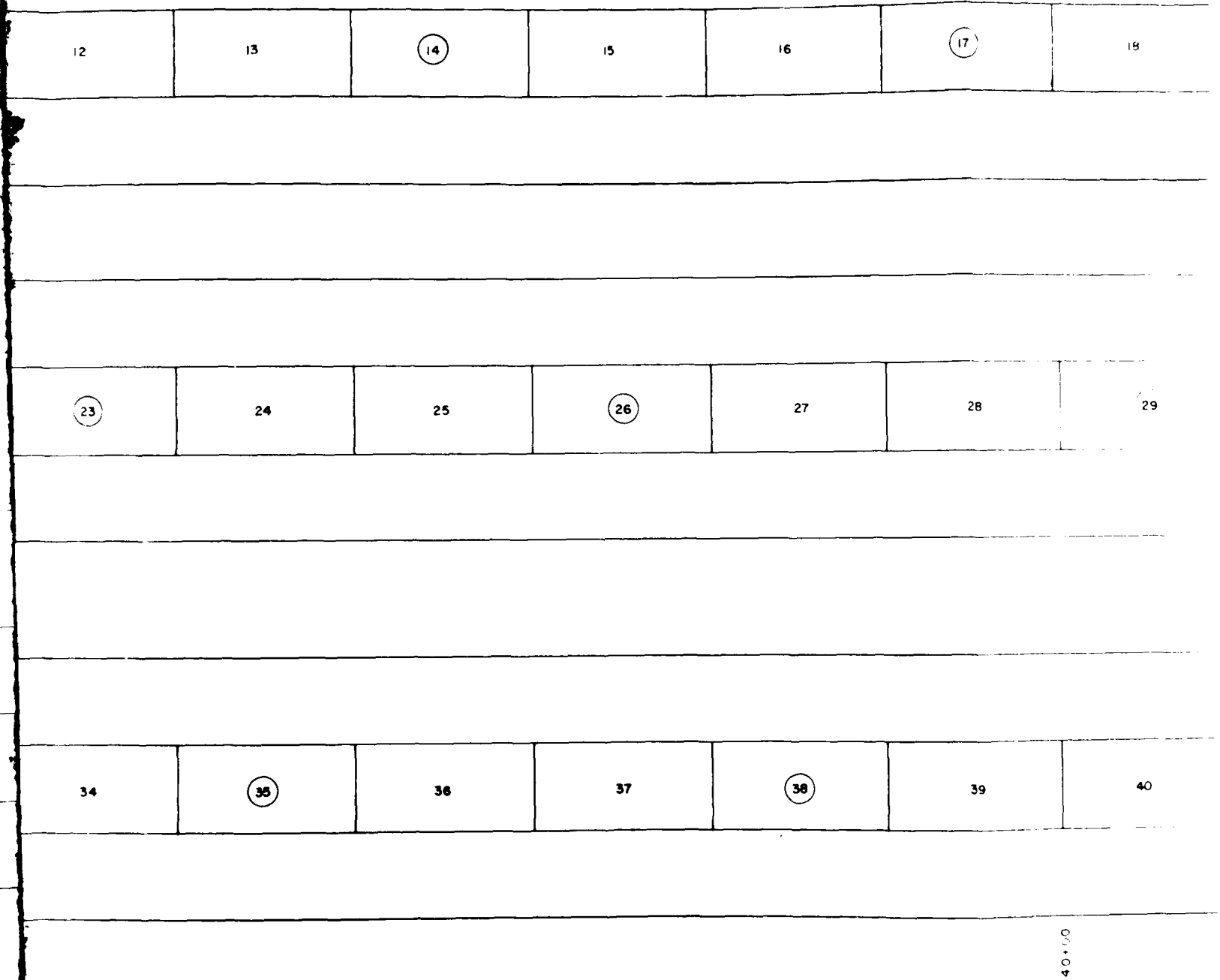
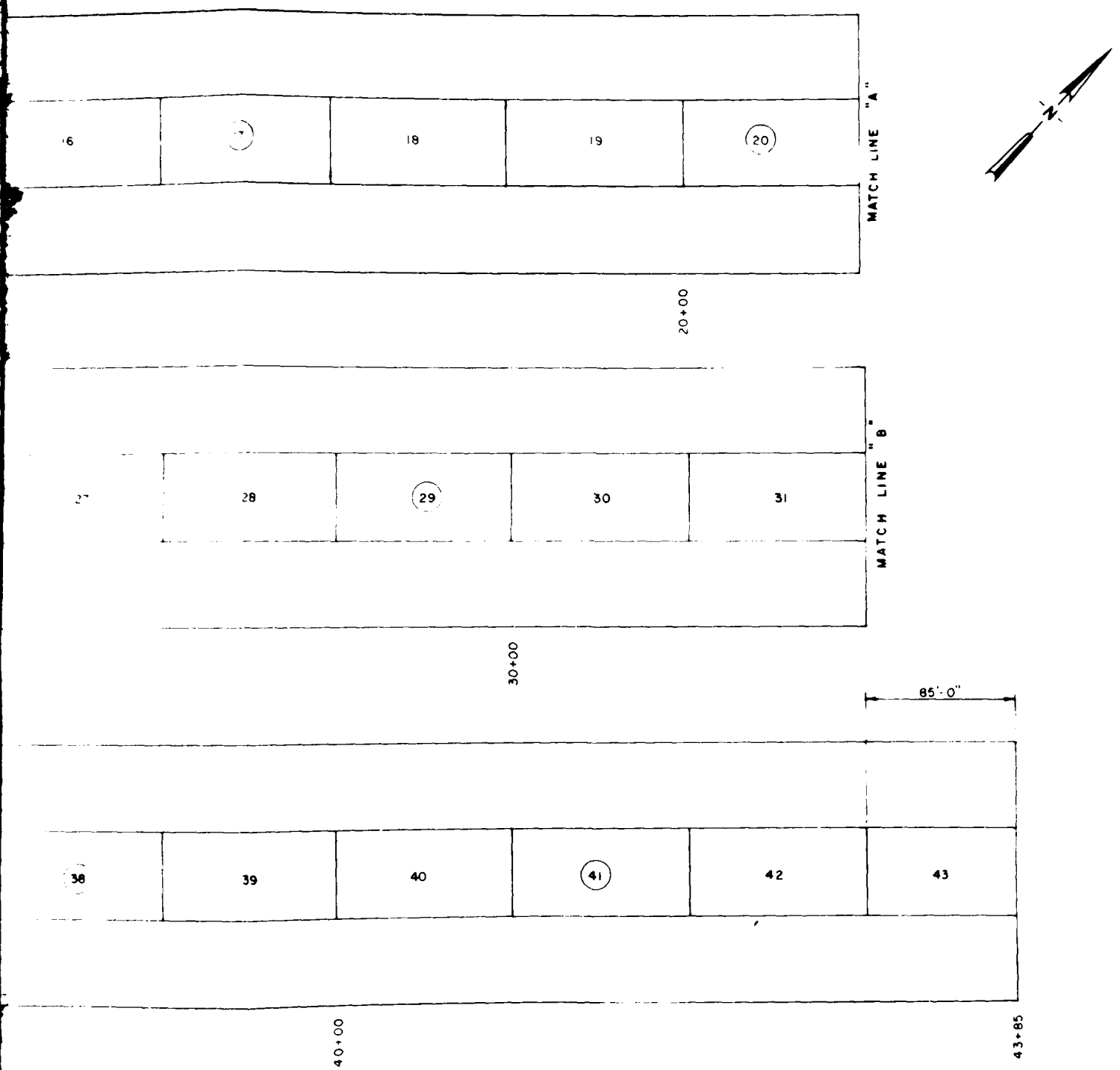


Figure 5. Sample unit layout, Runway 5-23 (Feature R3C)



nway 5-23 (Feature R3C)

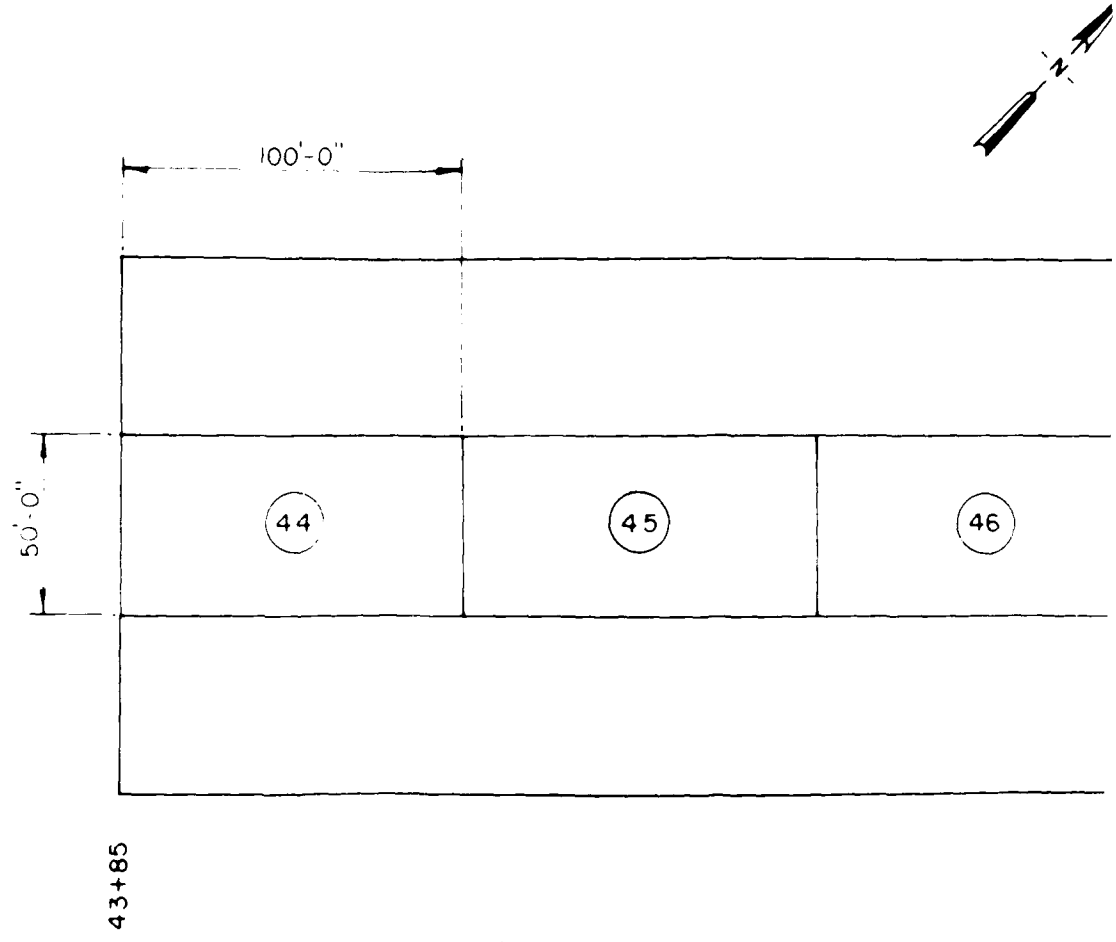
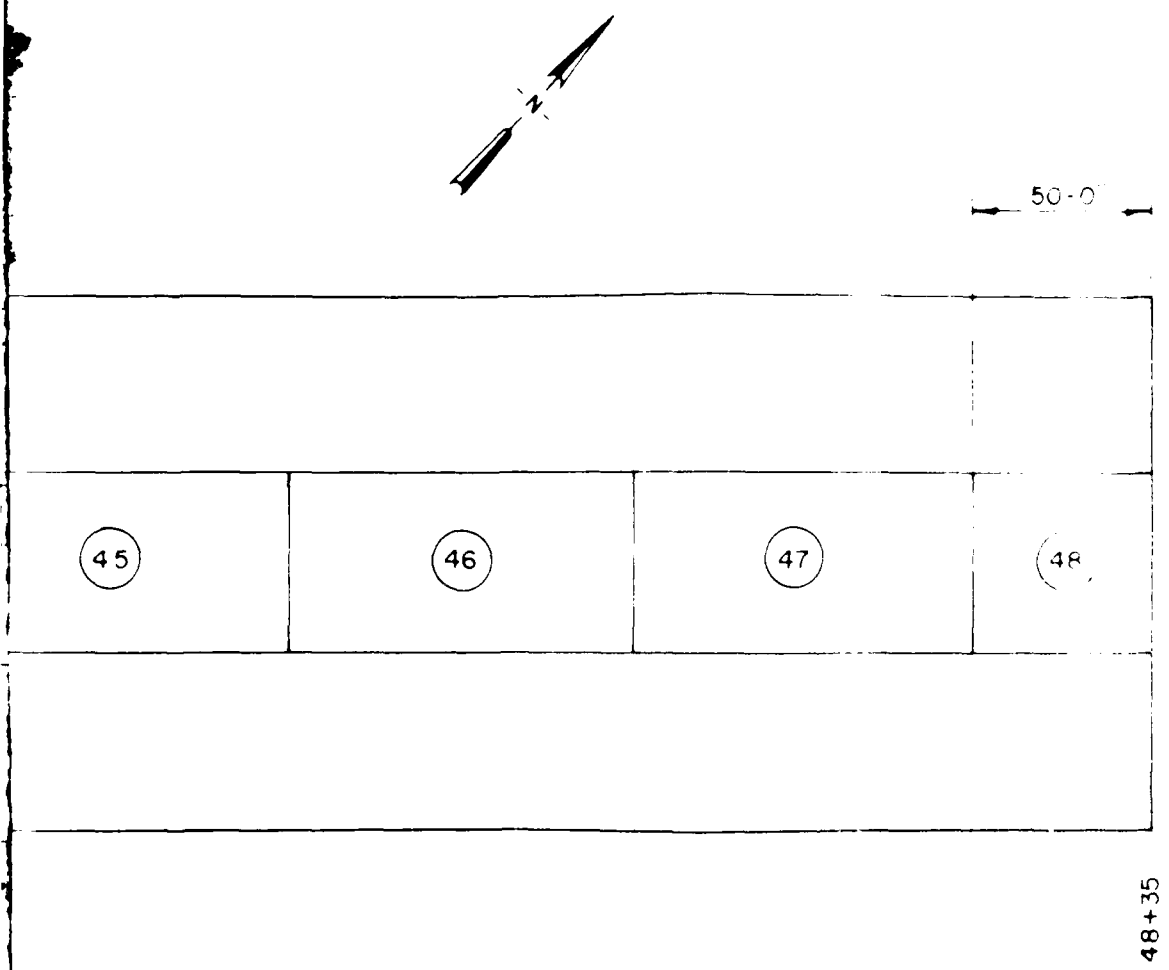


Figure 6. Sample unit layout, Runway 5-2



re 6. Sample unit layout, Runway 5-23 (Feature R4B)

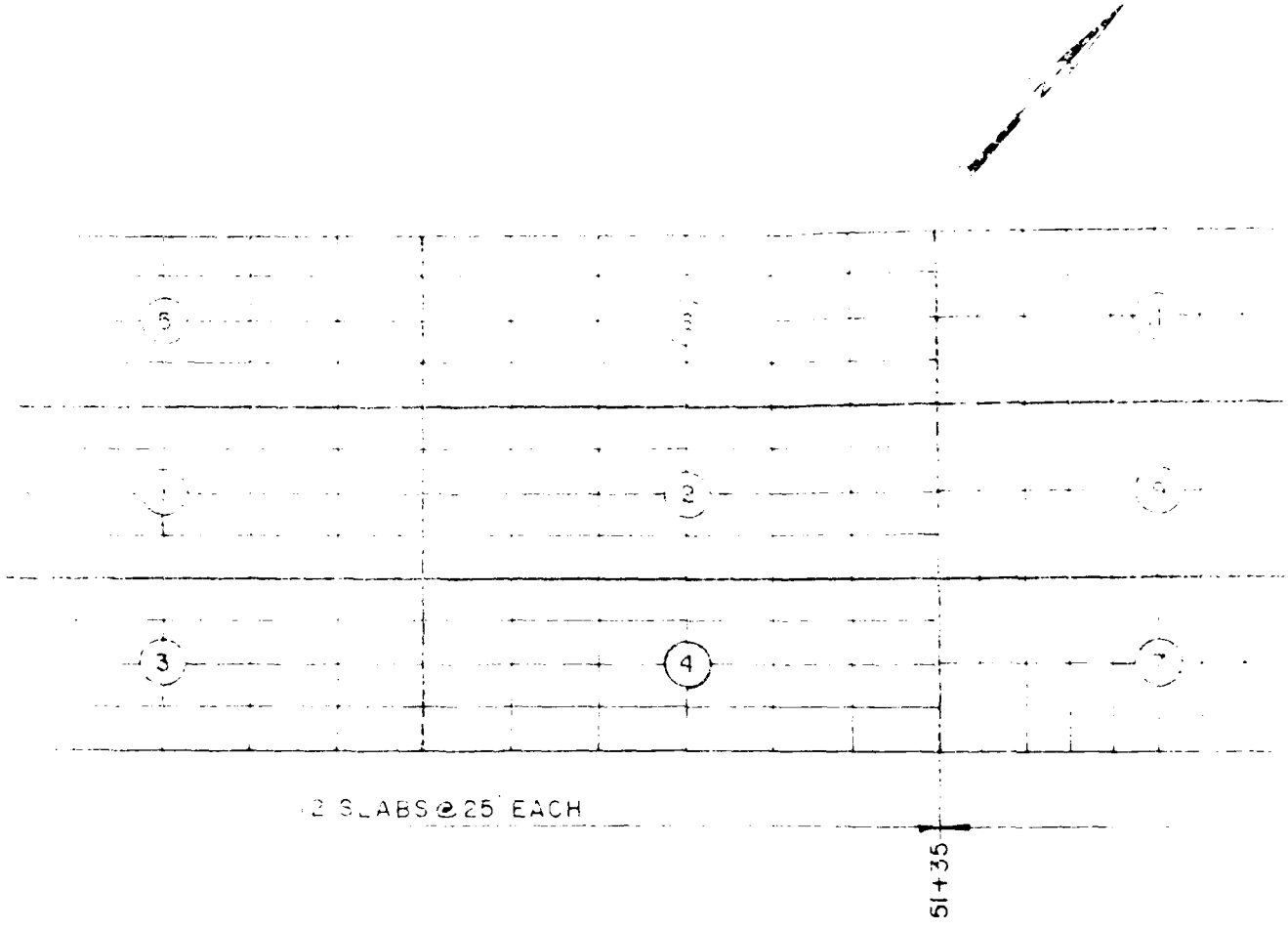
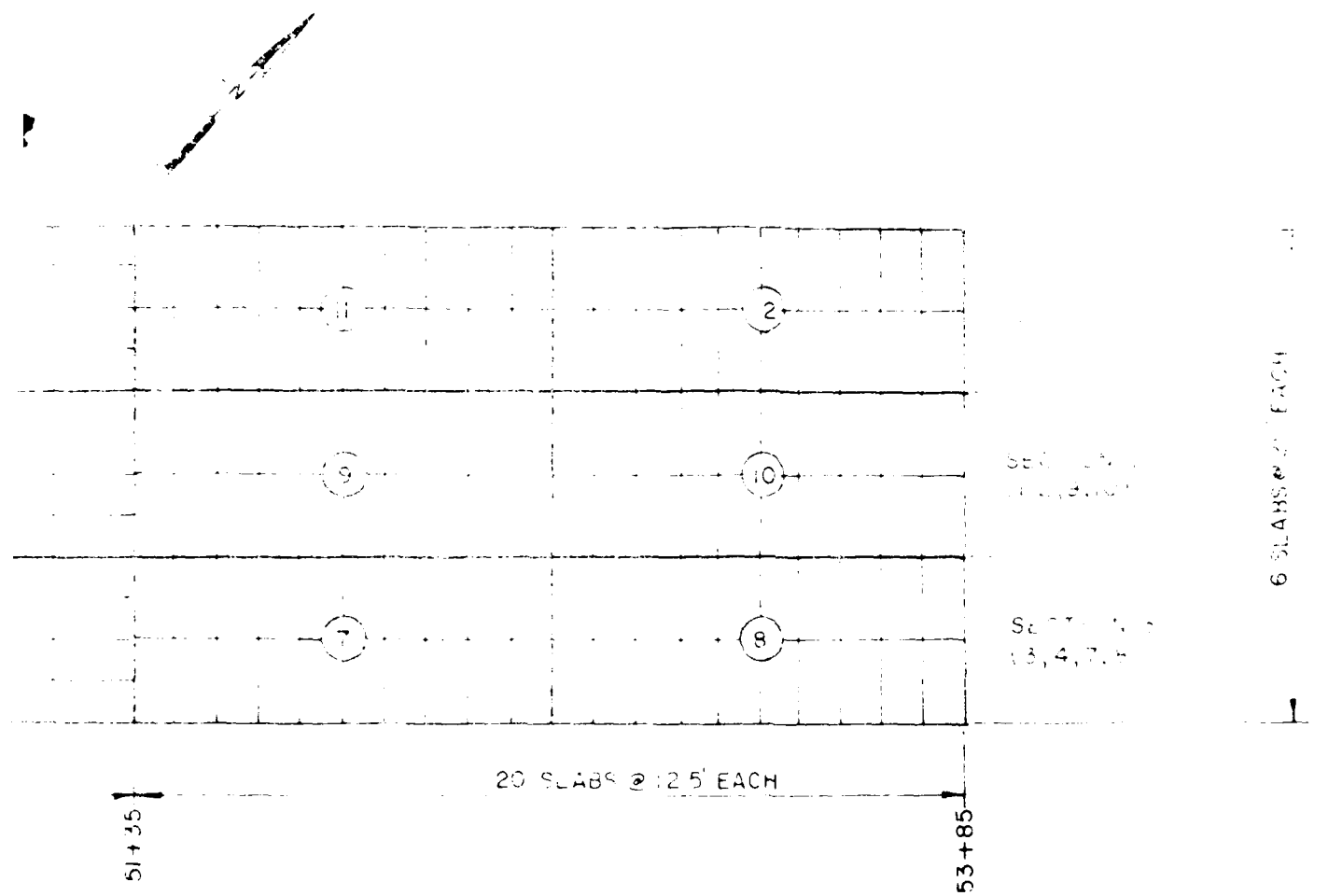


Figure 7. Sample unit layout, Runway 5-23 (Feature R



Layout, Runway 5-23 (Feature R5B)

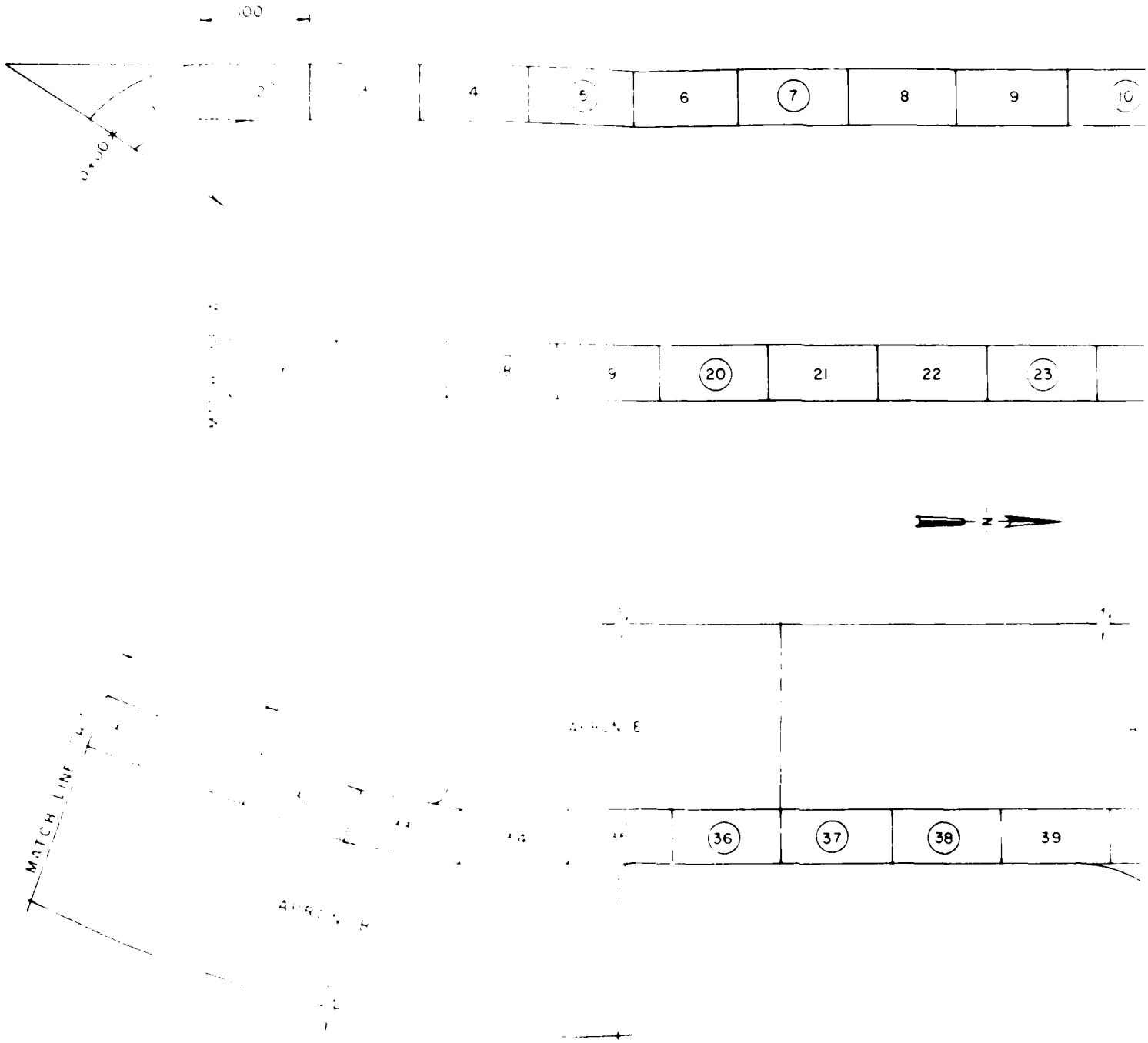
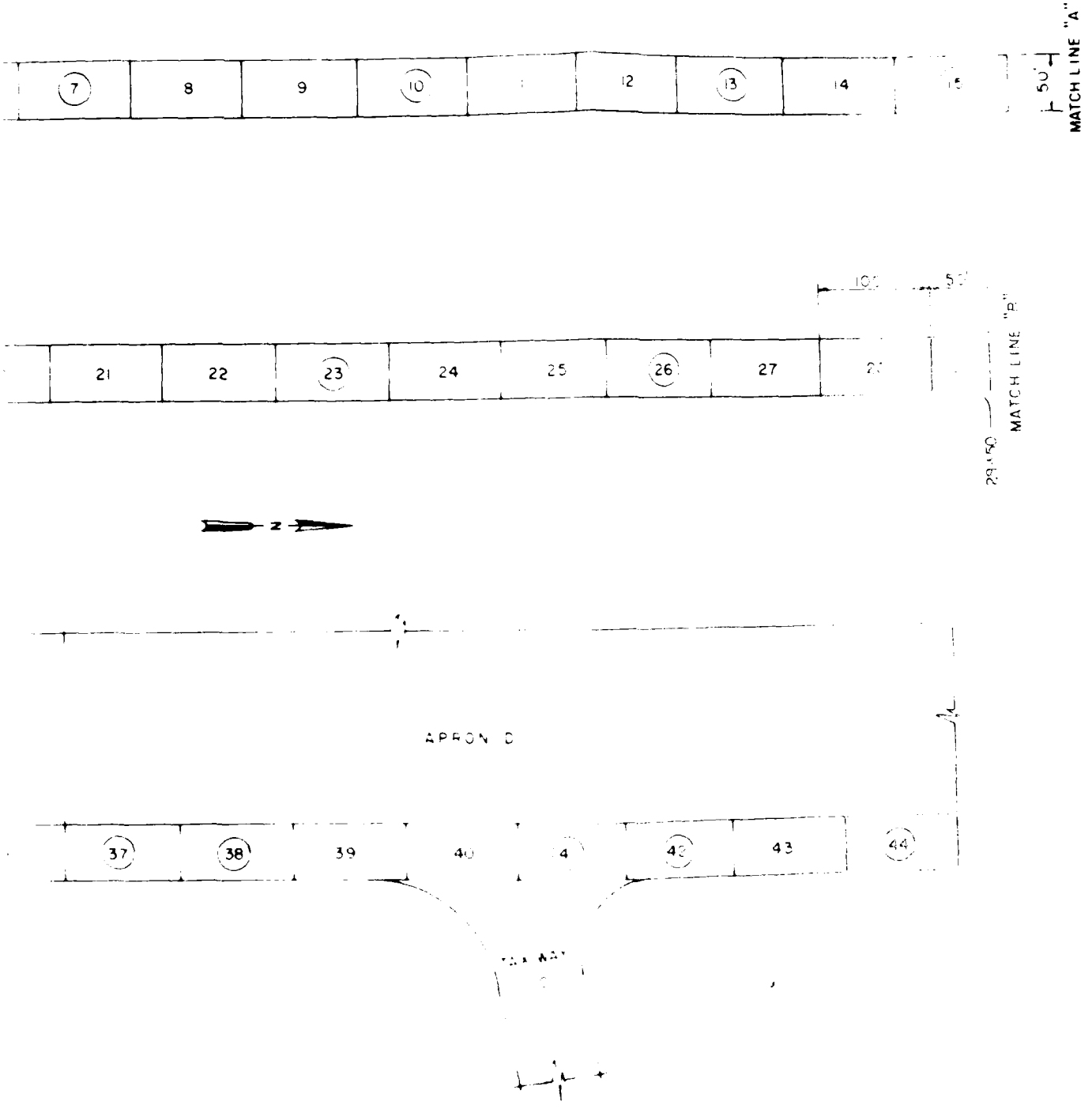


Figure [illegible]. Sample unit layout, Taxiways A and B (Features 1



Layout, Taxiways A and B (Features T1B, T2B, and T3B

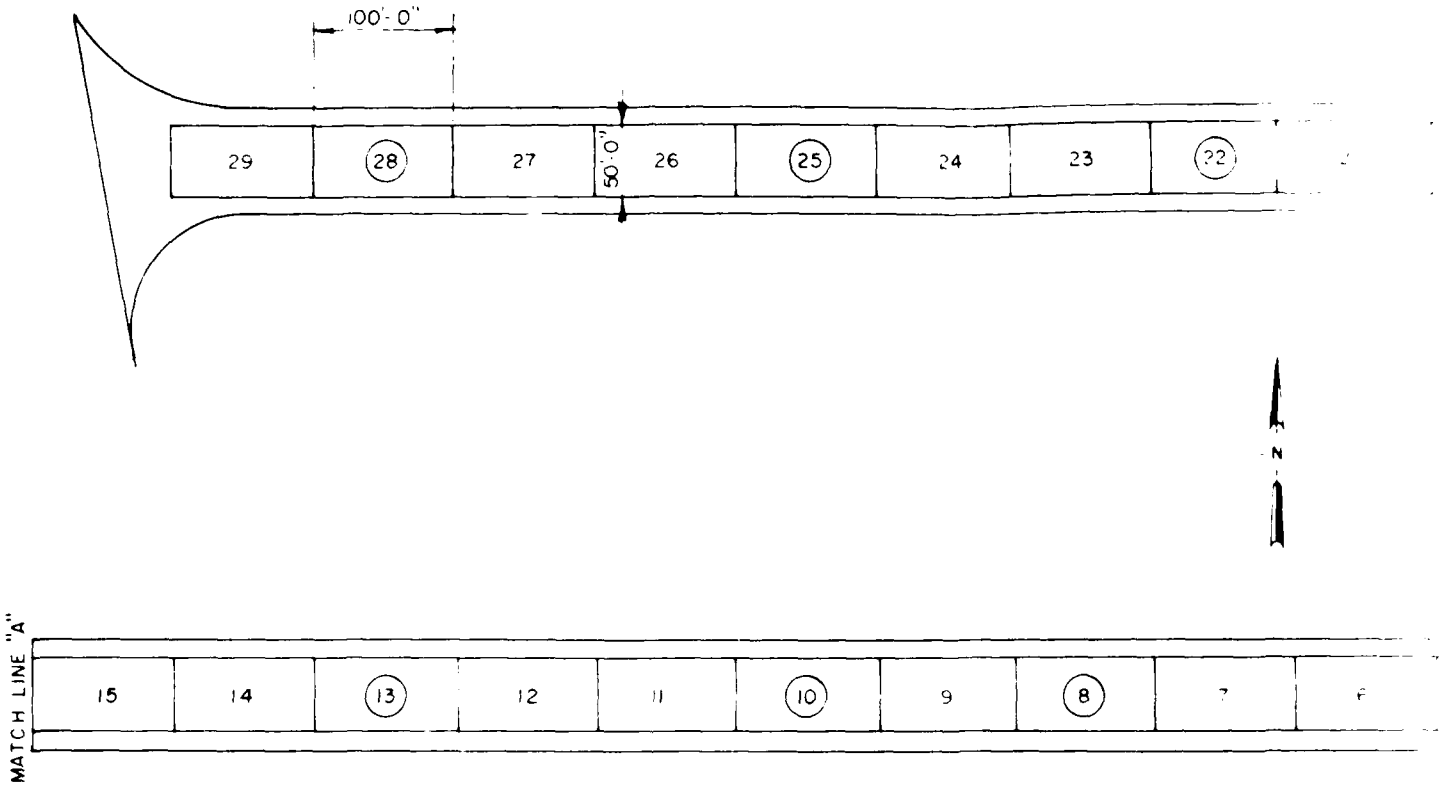
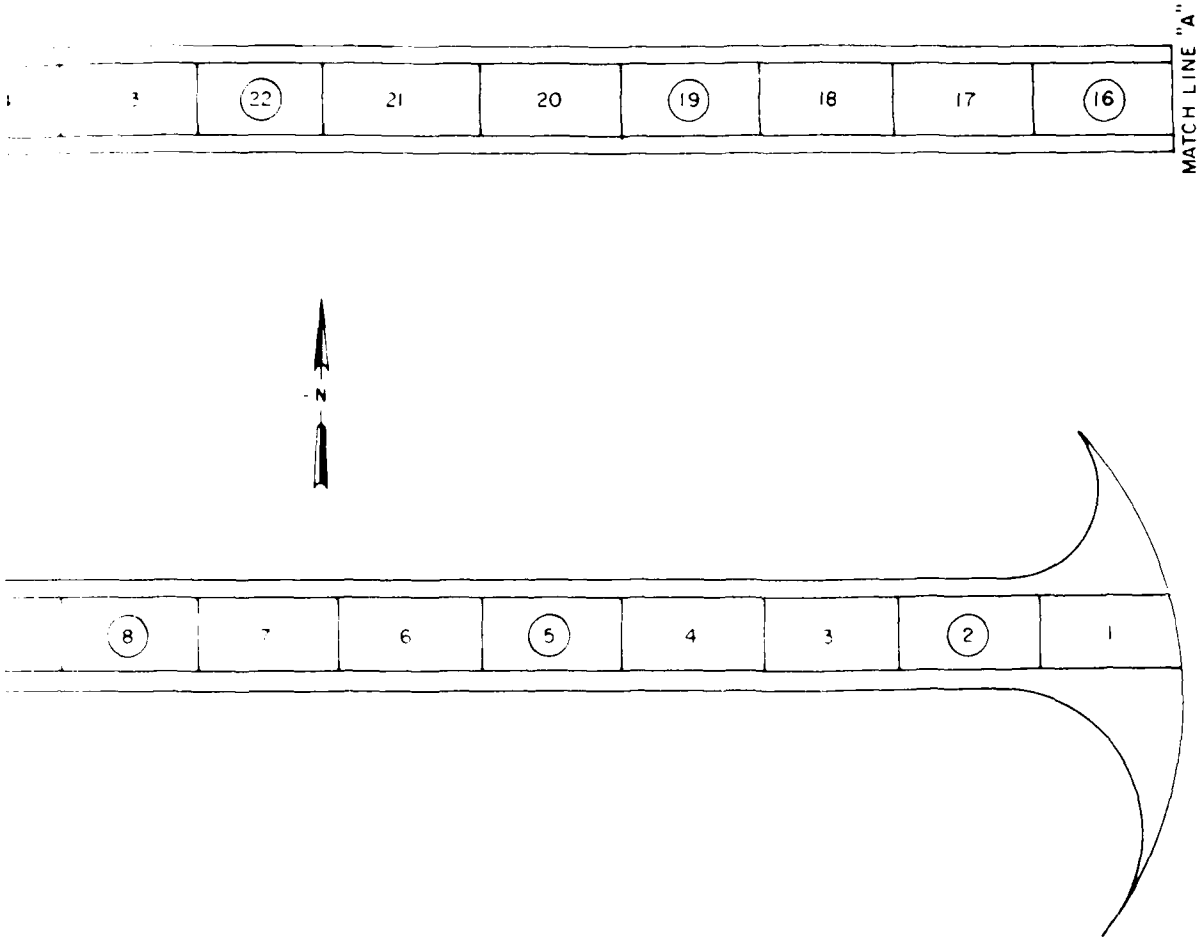


Figure 9. Sample unit layout, Taxiway C (Feature 7



unit layout, Taxiway C (Feature T4B)

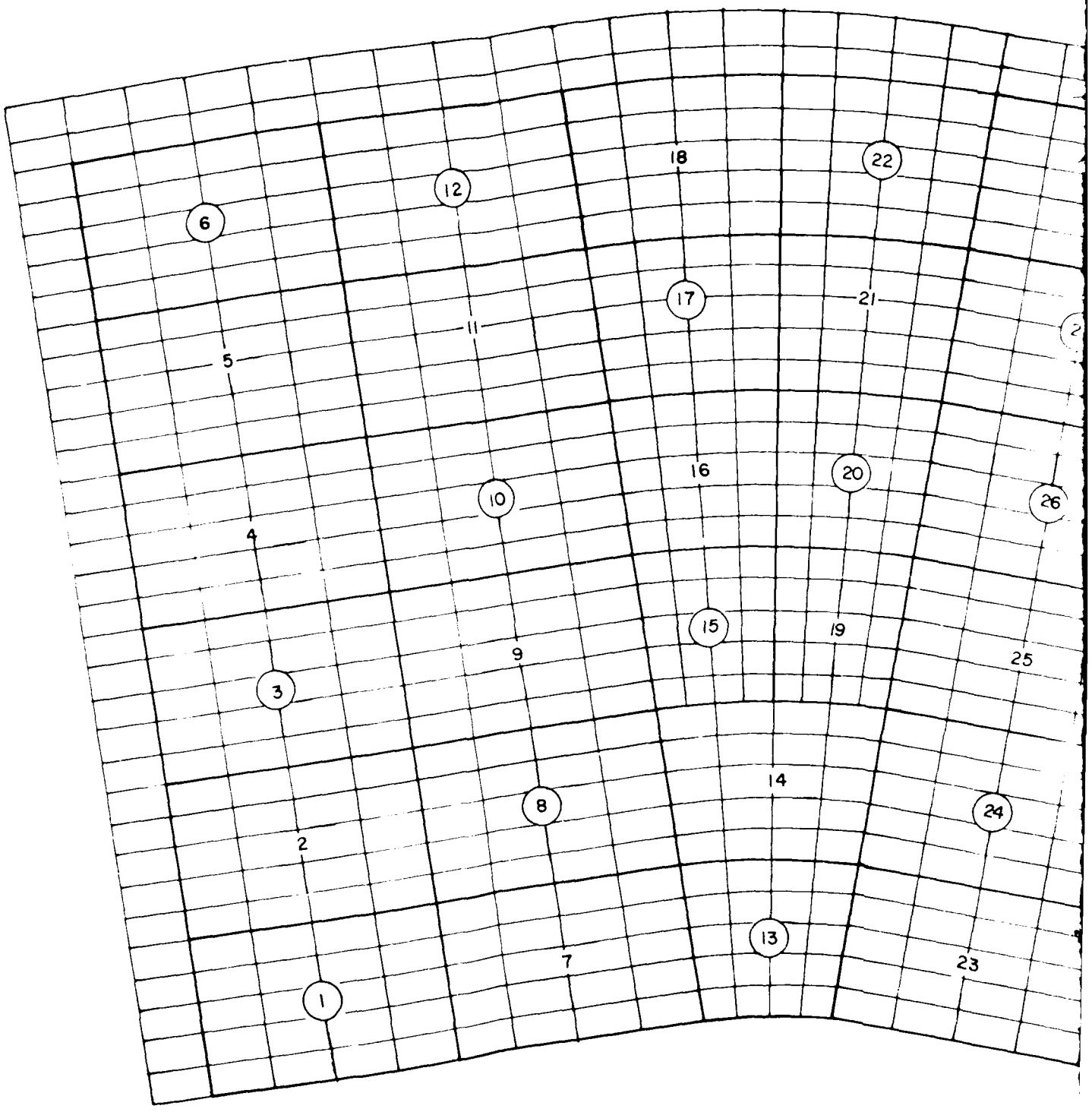
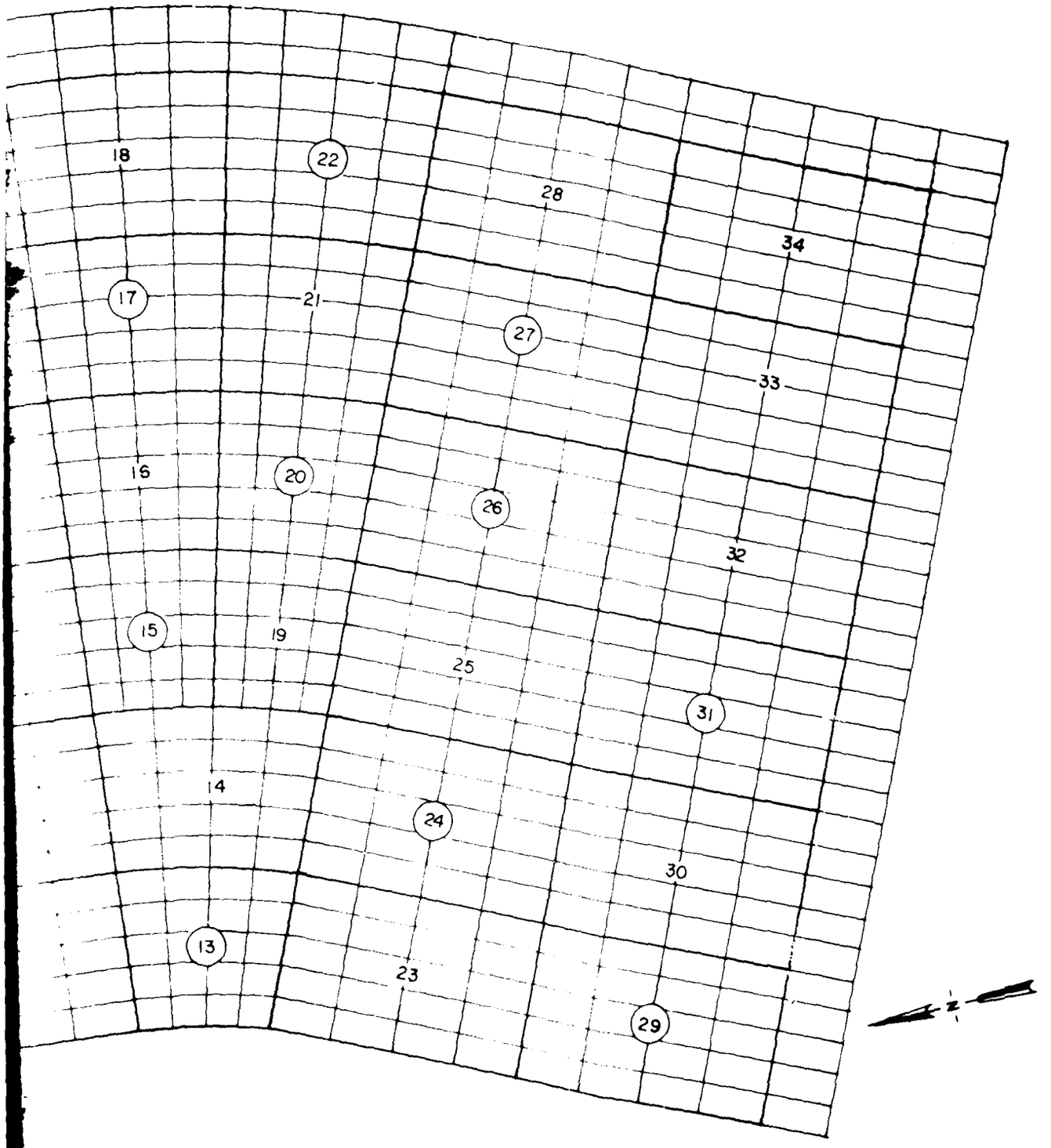


Figure 10. Sample unit layout, Apron B (Feature A1B)



mple unit layout, Apron B (Feature A1B)

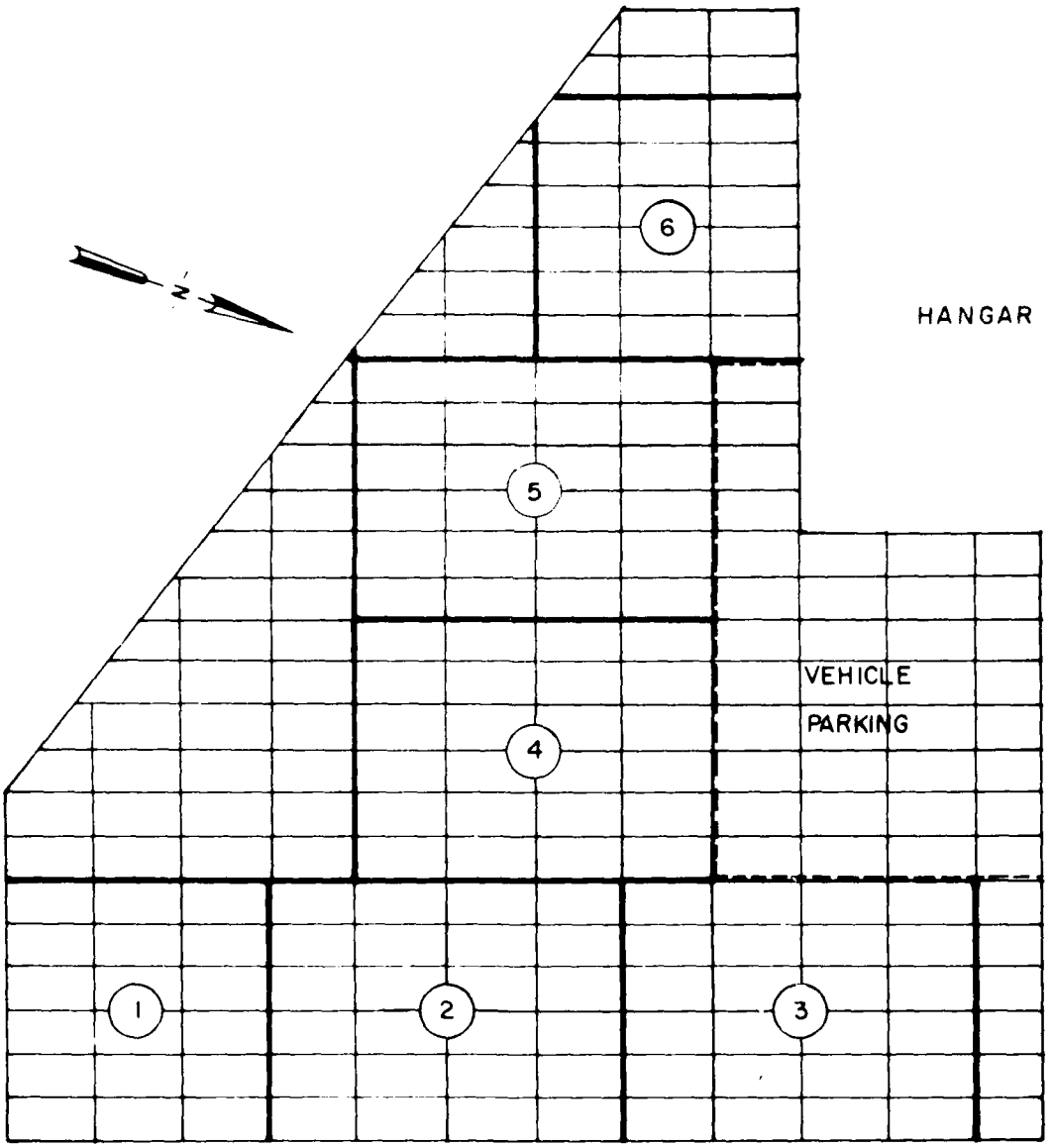


Figure 11. Sample unit layout, Apron E (Feature A2B)

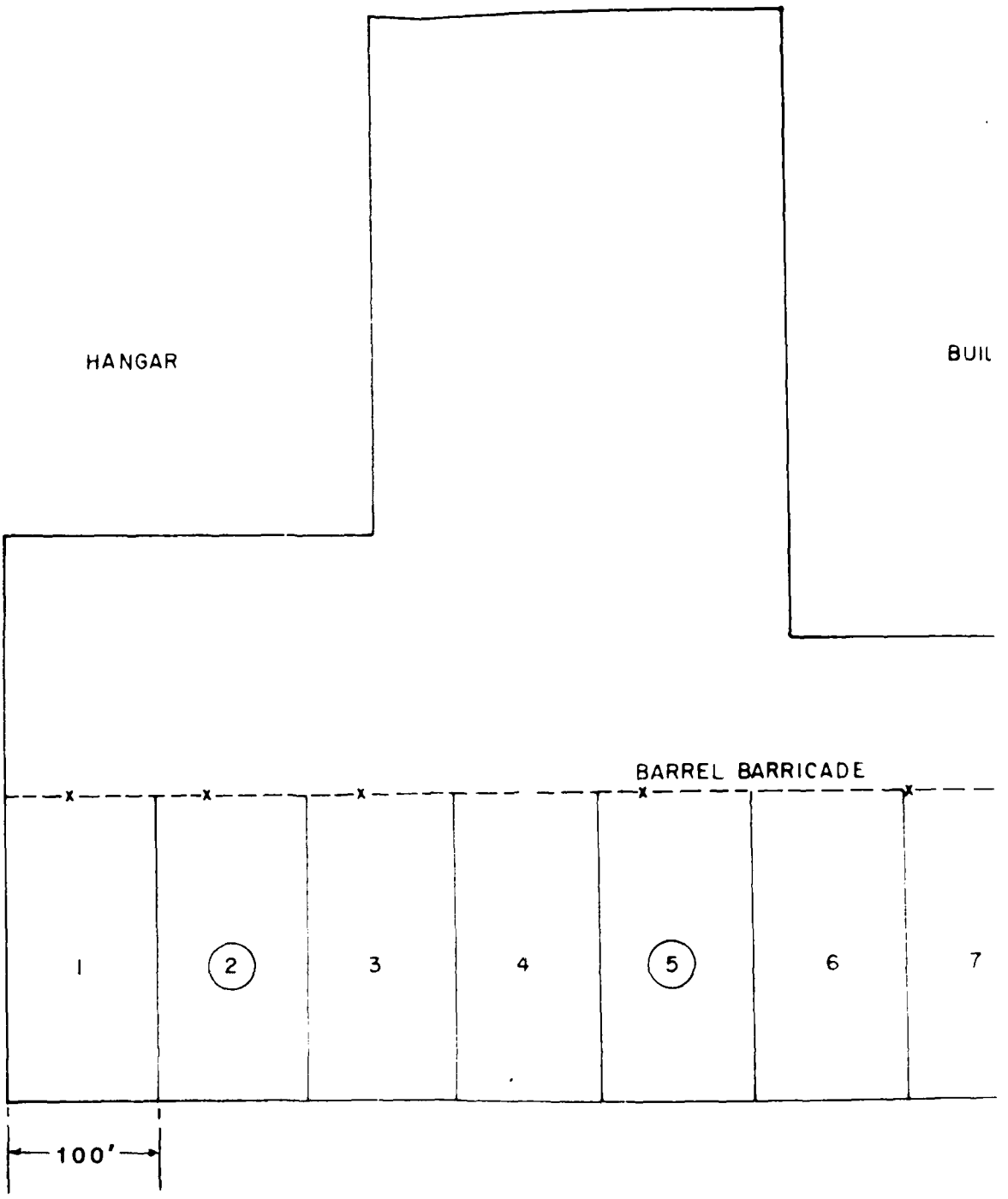


Figure 12.

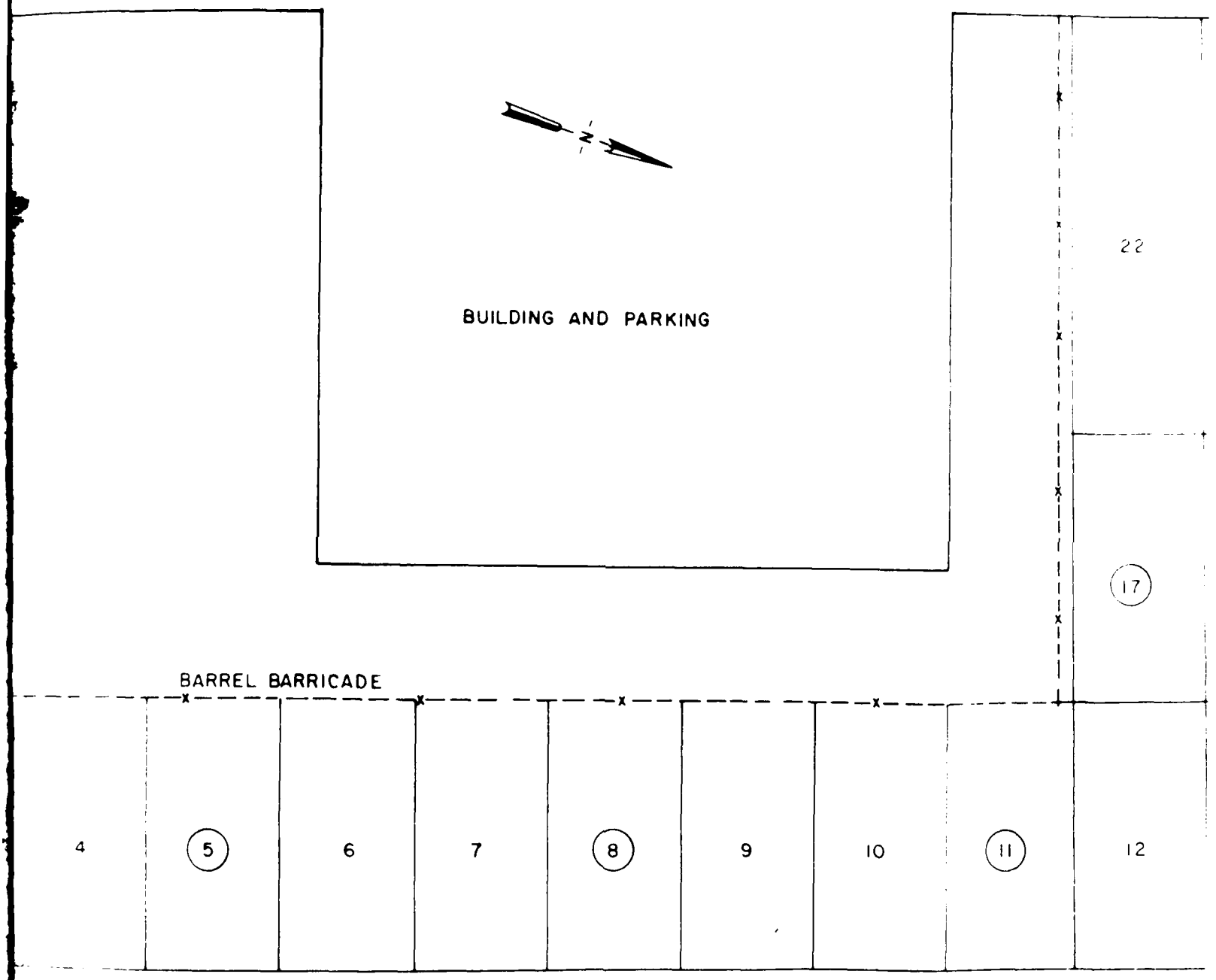
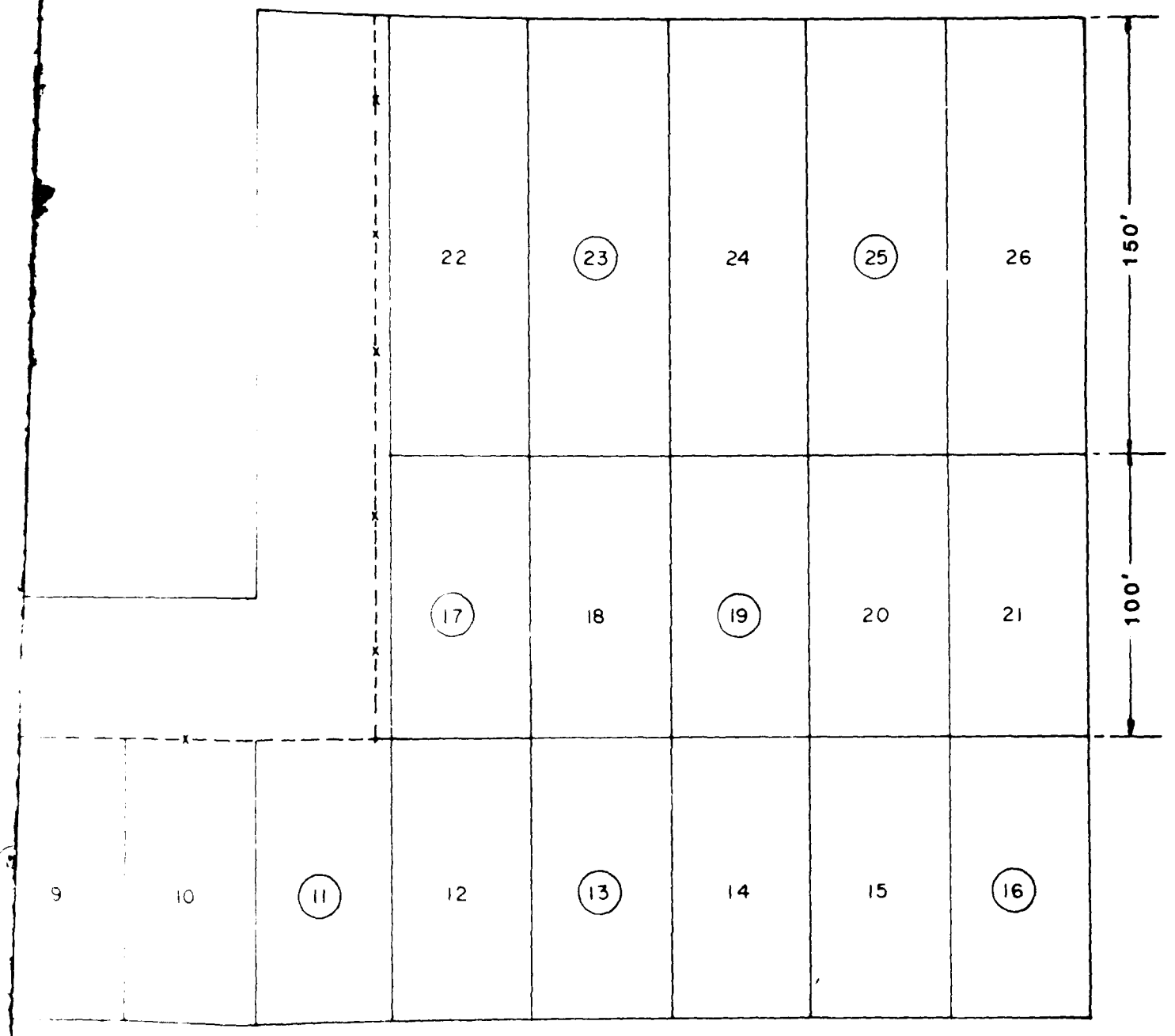


Figure 12. Sample unit layout, Apron B (Feature A-8).


22
23
24
25
26
150'
17
18
19
20
21
100'
9
10
11
12
13
14
15
16

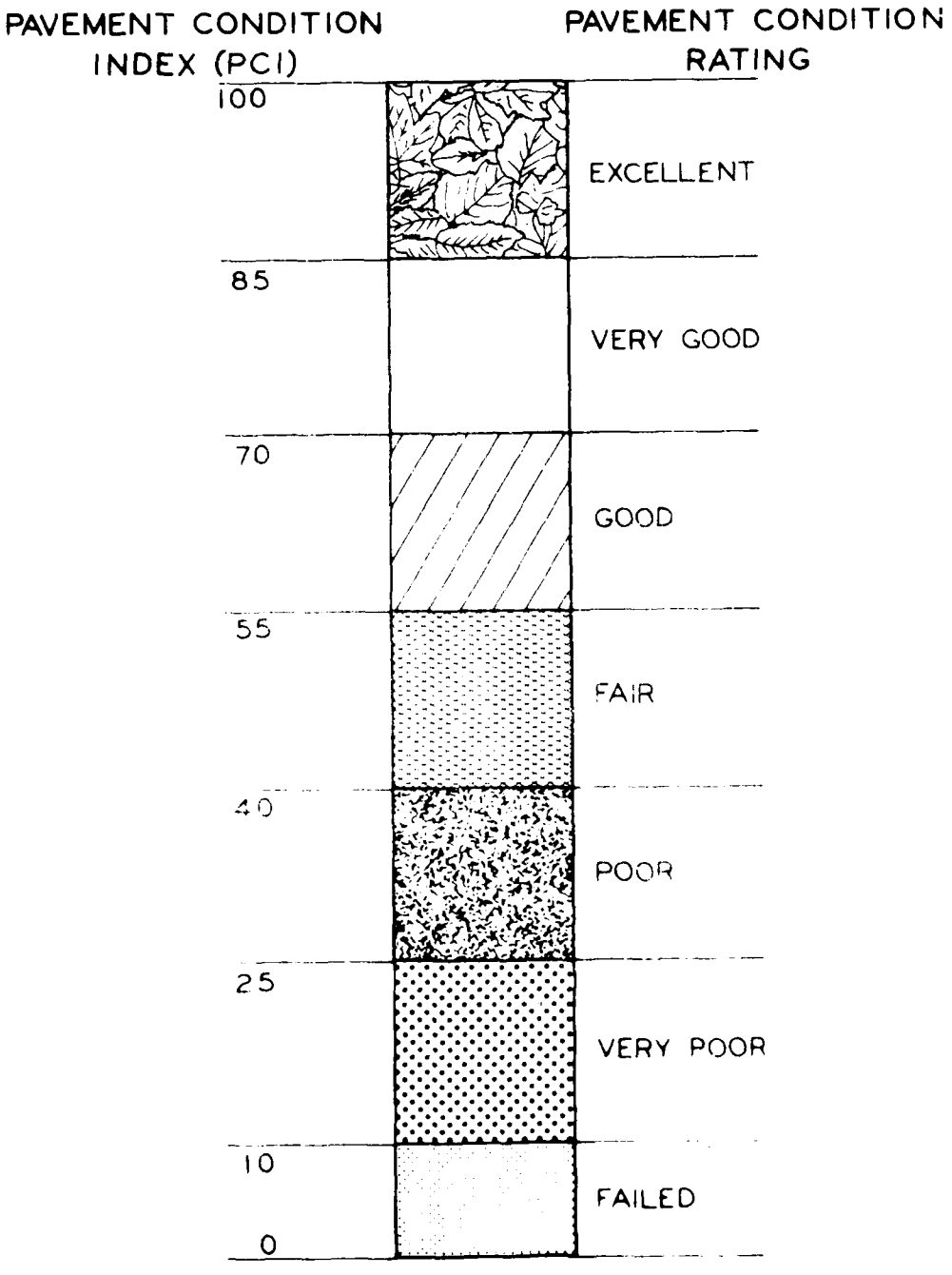


Figure 13. Scale for pavement condition ratings

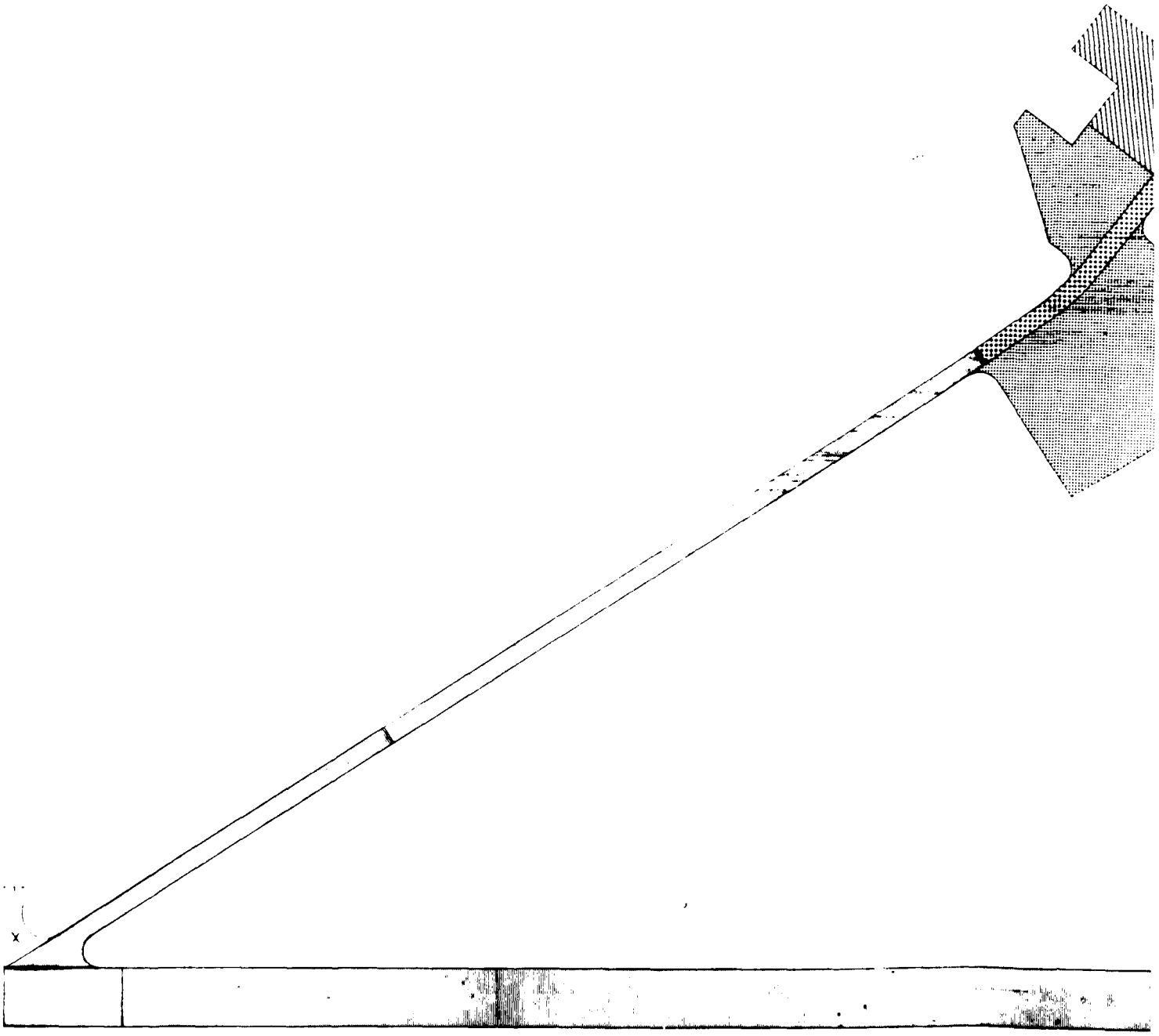
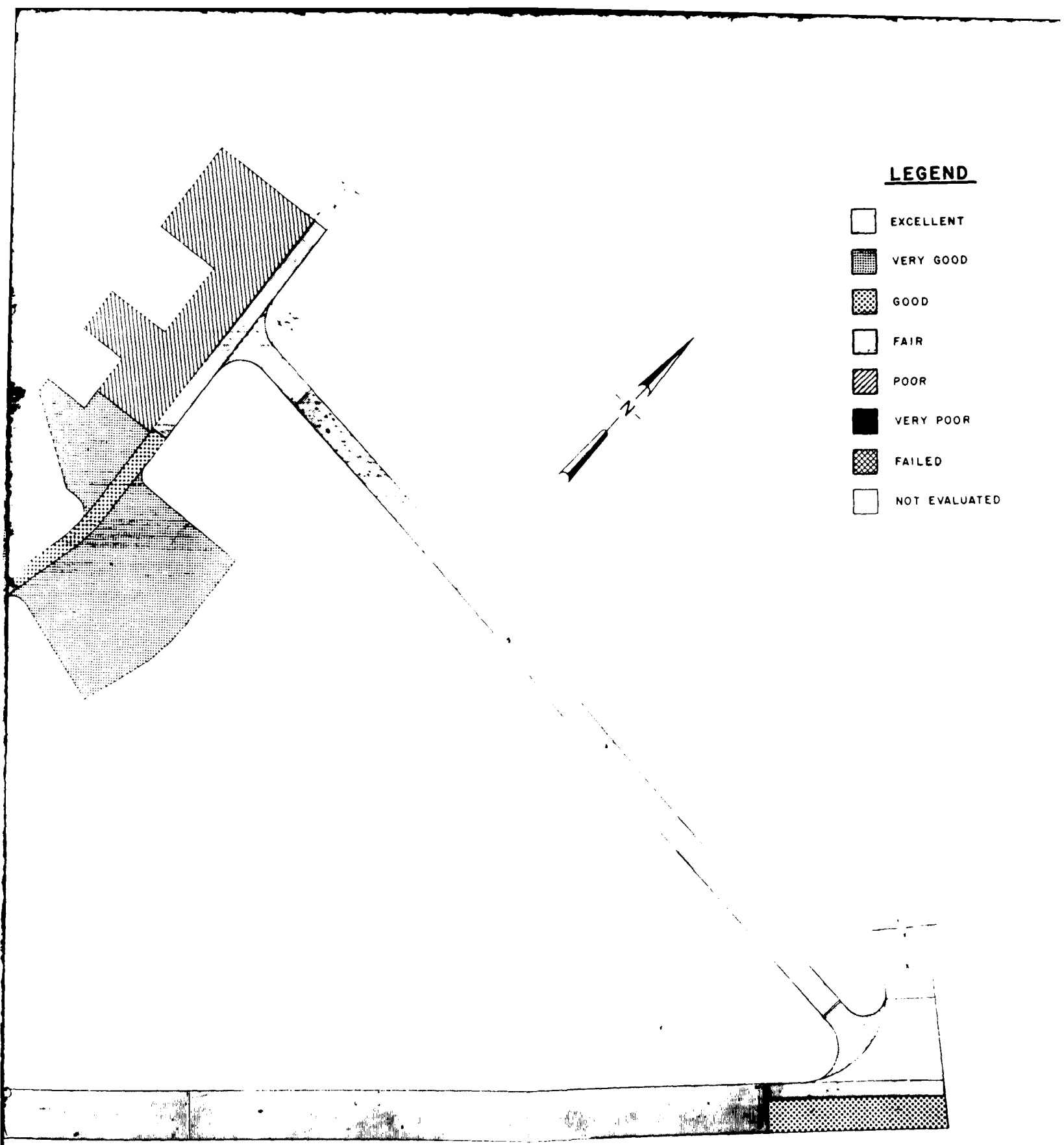


Figure 14. Pavement condition r



ondition ratings at Avon Park Range

Photo 1. Typical cracking and patching in PCC, Runway 5-23

Photo 2. Unfilled low-severity crack in PCC, Runway 5-23

Photo 3. Typical block cracking in asphalt, Runway 5-23

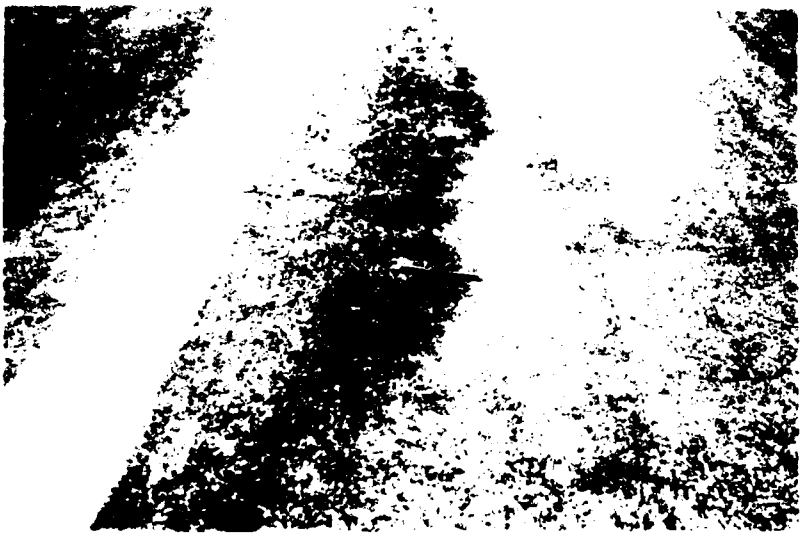


Photo 4. Close-up of poorly placed slurry seal, Taxiway A

Photo 5. View of cracking caused by uncut joint, Apron E

Photo 6. Close-up of old sealant, allowing incompressibles to enter the crack, Apron E

Photo 7. Typical block cracking in asphalt surface, Apron D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